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APPLE CULTURE IN VICTORIA.

(Continued from page 295.)

(By J. Farrell, Orchard Supervisor.)

Bitter Pit.

Incalculable losses due to the ravages of Bitter Pit are experienced by apple-growers every year. This disease, or rather undesirable degeneration and deterioration in the physical condition of the fruit, particularly during its later development, is more prevalent in some seasons than in others. Some varieties are very subject to infection while others are partly immune. Cleopatra is probably the best example of those in which free development of Bitter Pit is found, and Yates may be regarded as the most resistant of those enjoying partial immunity from it.

The first evidence of Bitter Pit, when the apples become affected on the trees, is the appearance of comparatively small, shallow, dark isolated depressions in the rind of the fruit. These depressions, which, in the case of moderate infection, occupy only the calyx end of the apple, became visible in early varieties about the time they commence to ripen. In these the pitting develops rapidly, but as a rule not so extensively as in the midseason and late ripening sorts. The late ripening varieties often show pit even before they attain full size, but generally speaking, the fruit, when attacked on the trees, suffers more during the ripening period than in any other stage.

Plate 198 illustrates a Cleopatra apple affected with Bitter Pit. This fruit was almost ripe when picked and photographed. Fig. 1 depicts it as a typical diseased specimen of this variety. Fig. 2 is the same apple showing in the pulp of the portion from which the slice was removed the deep-seated nature of the pitting. When a section of one of the pits is made by cutting through the rind, and the diseased pulp beneath it, the skin is apparently quite sound, but the cells are brown

in colour, and when an advanced stage of deterioration is reached they become withered and shrunken.

Usually William's Favourite is the first of the early varieties to show Bitter Pit on the trees This occurs about the middle of January, and the identification marks may be traced through the other varieties in their order of maturing until the Sturmer Pippin, the last of the late ripening sorts, becomes affected about the middle of May. The fruit of trees making rank growth on rich, imperfectly drained, yet, not absolutely sour soils is more subject to Bitter Pit than that produced on trees of moderate growth on the lighter sweet soils. Under either set of conditions excessive rain or unusual atmospheric humidity seems to intensify the pitting, but more so in the case of the former.

On completing his exhaustive investigation of this matter on behalf of the Federal Government, Mr. D. McAlpine in his fifth report (p. 60) concerning the cause of Bitter Pit states: —

> "I am of opinion that over-pressure of water in the tissues, leading to local rupture and subsequent death of the parts, furnishes the most probable explanation of Bitter Pit."

In page 66 of the same report, in further explaining his theory, Mr. McAlpine writes: —

> "The result of this investigation goes to show that the primary cause of the trouble is the extra pressure of sap in the outermost layer of pulp cells to begin with, causing them to burst and collapse, together with the rupture of the vascular network associated with them. A large number of well-established facts have been brought forward to support this view, which has suggested the best known means of reducing the amount of pit in the orchard, and these remedies are supported by experimental evidence."

Simultaneously with Mr. McAlpine's investigations Professor Ewart conducted a number of highly scientific experiments with a view to determining the cause of the disease, and he claims that the results obtained indicate that the condition of the pitted parts of the fruit is consistent with local poisoning.

The nature and results of the experiments were embodied in a series of papers read before the Royal Society of Victoria, and subsequently published as pamphlets. The following extract is taken from the pamphlet issued September, 1917, wherein the Professor states: —

> "Every symptom of this defect can be produced by the artificial application of poisons, including the presence of starch grains in the dead cells.
>
> Various observers have noted similar results in the leaves and young stems as the result of the application of poisonous sprays (patches of dead tissues with brown shrivelled cells packed with starch). In apples the sensitivity is so great that the poisoning may be oligodynamic, *i.e.*, poisoning may occur in the presence of traces of poison beyond detection by ordinary chemical analysis.
>
> As apples ripen the sensitivity of the pulp cells to poison increases, so that the apparently sound apple may develop Bitter Pit after it has been picked.
>
> There is a close correspondence between resistance to poison and resistance to Bitter Pit. The most re-

sistant variety to Bitter Pit (Yates) is also the most resistant to poison. Varieties specially sensitive to poison are also specially sensitive to Bitter Pit. There is also a close correspondence in regard to temperature effects. At low temperatures the development of Bitter Pit is checked or retarded. Similarly at low temperatures the resistance to poisons is greatly increased, being 10 to 100 times greater at 0°C. what it is at 25°C."

The following extract, which explains how poisons could be absorbed from the soil by the delicate hair-roots and cause pitting of the fruit, is taken from the pamphlet issued, September, 1913:—

"It is well known that the roots of various plants can absorb traces of various mineral poisons which may accumulate in special parts or organs, particularly such as are ultimately thrown off (leaves, bark, fruits), without either the roots or the plant as a whole being affected. The following poisonous metals may be absorbed by various plants when grown on soils containing them Zinc up to 13 per cent. of ash, manganese up to 14 per cent., cobalt, nickel, mercury, silver, copper up to 1 per cent., lead, thallium, arsenic, titanium, &c. These absorbed poisons are either set aside in special parts or cells sacrificed as poison traps, or may not cause any injury at all if the plant has developed the power of precipitating them in an insoluble or innocuous form."

The question of Bitter Pit has for many years engaged the attention of the officers of the Orchard Supervision Branch. The following extract is taken from a contribution by Mr. P. J. Carmody, Chief Orchard Supervisor, published in the report of the Department of Agriculture for 1910, in which he gives his practical experience of Bitter Pit in the orchards:—

"As regards Bitter Pit, the co-operation of the practical grower and the scientist affords the best means from which we can hope to obtain knowledge that will lead to the amelioration of conditions that at present exist. This question has alike occupied the minds of, and caused anxiety to growers and exporters of fruit, and great, indeed, have been the losses on the fruit shipped last season From a careful study of this disease in the field for many years I have found the following as amongst its principal contributory causes:—

(*a*) Proneness of some varieties more than others to the complaint, *e.g.*, Cleopatra, Annie Elizabeth, Shockley, Sturmer Pippin, Northern Spy, and Winter Majetin.

(*b*) Over-developed fruit from young trees or old trees lightly cropped.

(*c*) Unevenly or suddenly developed fruit. It often happens that during the season a prolonged period of dry weather occurs during which the development is arrested or retarded, and on the fall of rain, sudden and unreasonable development ensues.

(*d*) Excessive nitrogenous manures, or soils in which nitrogen is superabundantly inherent, produce fruit noticeably susceptible to Bitter Pit.

(e) Faulty pruning. Many growers adopt a system of pruning so that their trees have as few as six to eight leaders. These are strong, vigorous, and upright, with correspondingly vigorous and superabundant lateral growth. In varieties subject to the disease, no consideration is given to choking back the sap, checking rapid movement, opening up the tree for the beneficial influences of light, heat, and air, and the placing the fruit on those parts where development is least likely to be excessive or rapid. Of course, I do not wish it to be inferred that any system of pruning can control the complaint, but certainly no system should be adopted that will accentuate it."

The officers of the Orchard Supervision Branch all agree with Mr. Carmody's conclusions. His views are further supported by Mr. McAlpine, who in summing up the results of his investigations concerning the control of Bitter Pit in his fifth report in 1916, page 66, writes:—

"The cause having been considered, the control of the disease may now be attempted from a rational stand-point. Whatever tends to regulate the "flow of sap" and distribute it to the various fruit-buds so that each receives its due share without being overgorged, will also tend to prevent pit. It is evident that pruning is a great factor here, and it has been proved experimentally that the pit in a susceptible variety, such as Cleopatra, may be reduced to 4-6 per cent. by this means."

Even when the trees have been scientifically pruned and the fruit matures apparently free from infection, the insidious nature of the contributory cause or causes of the disease often enables it to develop rapidly at the time of ripening or later when the fruit is stored in the ordinary way. The pitting may, however, be considerably restricted by placing the fruit in a cool store just before the ripe stage is reached, and by keeping the cool chamber at a fairly low and uniform temperature, say 31 to 33 degrees Fahr. Owing to the insidiousness of the disease it is obvious that the work of picking and storing, when commenced, should be promptly executed.

The experience of the writer while Government representative on the Croydon Cool Stores Trust, as well as that gained by visiting other cool stores is that it is extremely difficult to keep some varieties, particularly Cleopatra, sound.

In dealing with cool stores as a means of controlling Bitter Pit, Mr. McAlpine in his fifth report, p. 67, states:—

"It was one of the main objects of this investigation to prevent the loss due to this cause in oversea shipments of fruit, and this loss may now be prevented by the exercise of common-sense methods. By keeping the fruit in cool storage at a uniform temperature of 30-32 degrees Fahr., the development of Bitter Pit is retarded, and at the same time the ripening process is arrested. This is based upon the well-known principle that at that temperature there is a slowing down of the vital activities, and it is practically a case of suspended animation."

It would be expensive and difficult, if not absolutely impossible, to maintain in our country co-operative cool stores a temperature

sufficiently low and uniform to thoroughly control Bitter Pit. This is due mainly to the necessary daily admission to and discharge of fruit from the cool chambers, especially during the commencement of the storage season. But suitable temperatures are more easily maintained on ships fitted with cool chambers for the carriage of fruit under modern conditions.

While it is pleasing to know that cool storage is a factor in the control of Bitter Pit, it should be the aim of orchardists and others interested in apple culture to seek a solution of this question and find a remedy by which the pitting may be suppressed in the orchard where it originated.

It is recognised that the success of the fruit-growing industry in Australia will in future largely depend on the export trade. Apples are our principal exportable fruit, and large quantities are still destroyed annually by this disease. Consequently, the Bitter Pit investigation might with advantage be continued until the cause of this condition of the fruit is placed beyond dispute and a reliable remedy discovered.

The prospects of the resumption and extension of the export trade due to the cessation of hostilities in Europe should be a further incentive to deal comprehensively with this matter.

Jonathan Spot and Freckles.

Apart from the spotting of the fruit known as Stigmonose caused by insects—mostly by the Harlequin Bug (*Dindymus versicolor*)—all varieties of apples are liable to become disfigured by "spot diseases" other than those which cause apple scab and Bitter Pit.

Jonathan Spot and Freckles are two of the diseases referred to, and they usually appear at the end of the ripening period, if the weather be wet at the time, and particularly if cold winds then prevail. All varieties are liable to become affected with Jonathan Spot, but none is so subject to infection as the one after which this "spot" is named.

Plate 199 depicts the condition of an apple affected with this disease. The variety is Stone Pippin, and this apple was selected for the illustration for the reason that, being ripe, its yellow skin shows the spotting more clearly than would the darker rind of the Jonathan. This was the most extensively and perfectly marked specimen which has come under the notice of the writer. This condition of the fruit is often mistaken for Bitter Pit, and it is sometimes termed "surface pitting." Pits or depressions do occur in the rind, however, as may be observed in Fig. 1, but the spots are much darker than those caused by the true Bitter Pit. Fig. 2 is the same specimen, showing in the pulp from which the slice was cut, that instead of penetrating towards the core like Bitter Pit, the infection is confined to the skin and a few layers of cells beneath it. If the figures in this illustration be compared with those in Plate 198 the difference between Jonathan Spot and true Bitter Pit will be quite apparent.

The losses caused by Jonathan Spot in seasons favorable to it are sometimes serious, but these could be rendered infinitesimal by picking the fruit while dry and carefully storing it when matured. This spot is most in evidence when the fruit is allowed to remain on the trees after it has ripened, or when picked at that time and allowed to remain exposed in the orchard during wet, cold weather. The spotting sometimes develops in cool storage also, especially if the fruit be wet when

introduced. For this and other reasons, only fruit in a perfectly dry condition should be placed in the cool chambers. No matter under what storage conditions nor to what extent the spots develop, they maintain their superficial character and never assume the deep-seated nature of Bitter Pit.

Plate 198.

Fig. 1.—Cleopatra Apple affected with bitter pit.
Fig. 2.—Same specimen showing the deep-seated nature of the pitting.

Jonathan Freckles is another obscure disease which almost exclusively attacks the Jonathan variety, and thrives under somewhat similar conditions to those explained in connexion with Jonathan Spot. The freckles are mostly numerous and raised slightly above the plane of the apple's surface. They are at first small and of a creamy colour, but gradually develop and assume a bright golden tint. This condition of the fruit is illustrated by the reproduced photograph of the two

Jonathan apples in Plate 200. In Fig. 1 a few of the freckles have attained full size but the others are undeveloped. This specimen also shows where a portion of the rind with a freckle was sliced off, and the white pulp beneath indicates that it has not as yet suffered any

Plate 199.

Fig. 1.—Stone Pippin Apple affected with "Jonathan Spot."
Fig. 2.—Same specimen showing superficial nature of the spotting.

injury through the presence of the freckle. In the case of Fig. 2, however, the condition of the pulp is different. Here the freckles have reached a more advanced stage, and the appearance of the exposed pulp indicates that, although firm and apparently sound, it has become much discoloured.

Usually a few concentric circles appear in the fully developed freckle, which to the naked eye seem to be caused by a fungus. Other specimens affected similarly to those illustrated were submitted to Mr. C. C. Brittlebank, Vegetable Pathologist, for investigation, and he reported that no fungous organisms were found associated with the freckles. Luckily the freckles are of rather rare occurrence and the losses caused by them may be even more easily reduced to a minimum, than those resulting from Jonathan Spot, by adopting the precautions recommended in the case of the latter disease.

Cool Storage of Fruit.

The many private and co-operative cool stores erected in the various fruit-growing districts during recent years, as well as the patronage extended to those in the metropolis, show how the orchardists appreciate this method of fruit storage. By this means the marketing season is considerably extended and market gluts are prevented. Those who cultivate fruit extensively benefit by being enabled to regulate the supply to meet the demand. Small growers who do not cool store their

Plate 200.—Jonathan Apples showing freckles

fruit are afforded a better market with more remunerative prices. When the export of apples was suspended during the continuance of the war, the losses of many orchardists would have been ruinous but for the existence of cool stores.

Because of the success which has attended this phase of apple growing particularly, the stores built a few years ago have already had their holding capacity duplicated, and the duplication of others erected only recently is already being contemplated.

Our cool stores are substantially constructed wooden buildings with insulated walls and a padded close-fitting door to each air-tight chamber. A battery room is connected by two wooden air ducts to the chambers. A fan is placed in the mouth of one of the ducts to circulate the cold air from the battery room along this duct and through the chambers. By means of the other duct the air returns from the chambers to the battery where it is cooled and used again and again, thus maintaining the chambers at the required temperature. The ammonia process of refrigeration, which is based on the liquefaction and

vaporization of anhydrous ammonia, is employed. A suction gas engine of the necessary power is installed to operate the ammonia compressor and drive the fan in the small stores, while the refrigerating plants in the large stores are now worked by electricity.

This method of refrigeration is generally known as the cold air process. The direct expansion principle adopted in some of the private stores differs from this in that no ducts nor fan are employed, the battery being situated in the cool chamber.

Under the flat rate basis, which is adopted at most of the stores, the cost of holding apples during the storage period, February to November, varies somewhat, usually 1s. to 1s. 6d. per case being the charge. When the weekly scale of charges for shorter periods is adopted, these vary from 1d. to 1½d. per case. At these rates cool storage proves a boon to the producer and insures for the consumers a regular supply of fruit at reasonable prices.

Jonathan Scald and Sleepiness.

Although the Jonathan is the tenderest, most sensitive and easily injured of all apples under certain conditions, it is, nevertheless, regarded as the most profitable variety cultivated in this State. The sensitiveness of its rind is revealed in the orchard where russeting so often follows the application of Bordeaux mixture at strengths that would not prove injurious to other varieties. Its susceptibility to Jonathan Spot and Freckles affords further evidence as to the sensitive character of this variety. Strange though it may seem, however, the Jonathan apple offers a stout resistance to Black Spot, Bitter Pit and Crinkle.

There are two ailments, "Jonathan Scald" and "Sleepiness," which are liable to develop in apples when kept in the cool room. The former was originally known as "Cool Storage Scald." It attacks Jonathan, Rome Beauty, Rymer and others, but as the first-named is most subject to this infection, the disease is now known as Jonathan Scald. The scald first appears as a yellowish-brown blister in the surface of the apple, but when the pulp in the diseased portion becomes involved, the parts shrink and turn black. In many instances the scald, when it assumes a serious nature, penetrates to the core.

The four Jonathan apples in Plate 201, Fig. 1 illustrate this and show the external appearance of the fruit. In Fig. 2, the sections cut from the same four apples depict their internal condition. In most instances only a few apples in a case are infected, and no fungous organisms have been found associated with the scalding, which excessive atmospheric humidity and fluctuating temperatures seem to intensify. Sleepiness is mostly confined to the larger apples, but scald may develop in fruit of any size.

An experiment was made with a few Jonathans which were placed in the cool store on 31st March. They had developed the first signs of infection on 22nd June, and were on that date removed from the cool room to a dry situation with a natural temperature of about 45 degrees Fahr. The result obtained was that, although the specimens became somewhat wilted, the scalds having dried up, no further deterioration occurred and the pulp remained perfectly sound. After a period of 21 days the specimens were returned to the cool chamber kept at the normal temperature. The appearance of the apple in Plate 202 shows the condition of the fruit when again removed from the cool room

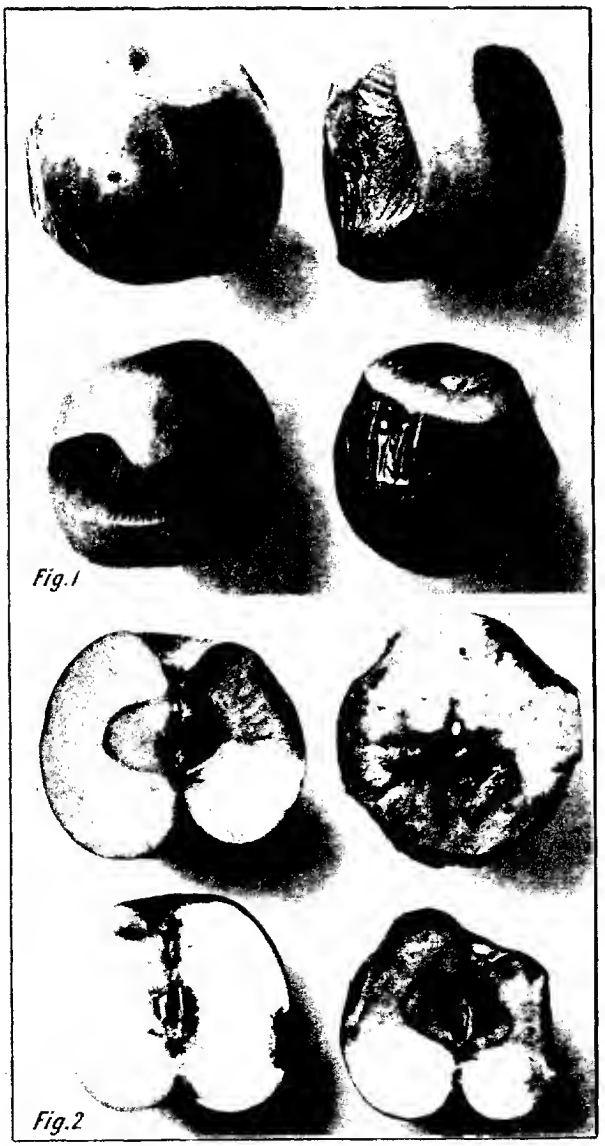


Plate 201.—Jonathan Scald.
Fig. 1.—Affected Apples showing external condition.
Fig. 2.—Section of same showing internal condition.

on 26th October to be photographed. In Fig. 1 the wilted but dry, firm condition of the rind may be observed, and Fig. 2 shows the point at which the scalding ceased and also the healthy state of the pulp.

Had these specimens not been treated in the manner described decay, as in the case of the affected apples left in the cool room, would have continued. It is not suggested that all fruit affected in this way should be treated as these specimens were—that would be impracticable. But the results obtained further demonstrate the necessity of cool storing only perfectly dry fruit.

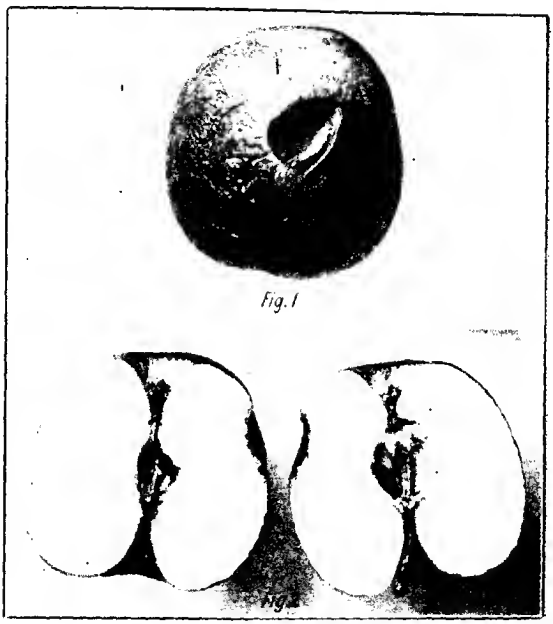


Plate 202.—Jonathan Scald.

Concerning "Sleepiness" it may be mentioned that, as this develops there are no outward signs to indicate that such an interior change in the apple is taking place. By a study of the Jonathan sections illustrated in Plate 203 the reader will be enabled to better understand the nature of this change from the normal. The presence of sleepiness may be detected, however, as the affected portion of the apple being rather soft yields to gentle pressure. If the skin of this part be broken during the first stage of the disease, the flesh will be brown and found to contain excessive moisture. In the later stage much of the moisture disappears and the flesh becomes spongy.

Sleepiness is not essentially a cool storage complaint; it sometimes affects fruit on the trees as well as that stored in the ordinary way. Large apples, especially Jonathan, are most subject to it, and particularly when heavy rains follow a dry spell, a week or two before the fruit matures on the trees. There is now ample evidence to show that large Jonathans grown under these conditions will not keep satisfactorily in cool storage. Such large apples should be marketed when ripe or disposed of previously for culinary use.

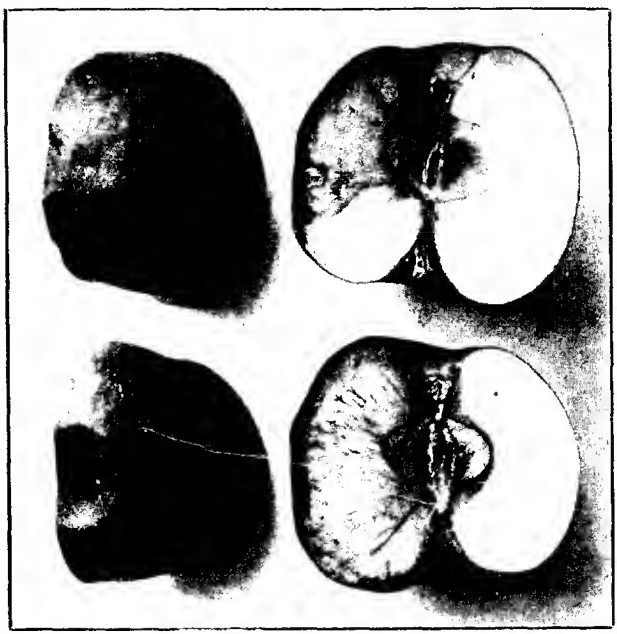


Plate 203.—Sections of Jonathan Apples showing the effects of sleepiness.

Grading, Packing, and Marking the Fruit for Market.

In dealing with the different phases of apple culture in sequence we now come to the grading, packing and marking of the fruit for market. The ultimate commercial success of the orchards depends to a great extent on the thoroughness with which these concluding details of the sequence are accomplished.

The most satisfactory results in marketing are obtained when the fruit is carefully graded according to size, colour and quality, put up in attractive packages and branded with grade marks. The lack of regularity in these respects was very noticeable, and with a view to improvement by securing uniformity the *Fruit Act* 1917, No. 2917, was passed by Parliament.

The sixth schedule under this Act defines the grade requirements for apples as follows:—

Grade A.

All apples in this grade shall consist of specimens of not less than $2\frac{1}{2}$ inches in diameter, excepting that normally small varieties, such as Fameuse (Pomme de Neige), Yates, Summer Pearmain, &c., shall consist of specimens of not less than $2\frac{1}{4}$ inches in diameter.

Wholly red varieties, such as Baldwin, Black Ben Davis, Hoover, Jonathan, King David, &c., shall, when such varieties are not less than $2\frac{3}{4}$ inches in diameter, consist of at least 75 per cent. of specimens of good red colour for the variety, and if less than $2\frac{3}{4}$ inches in diameter shall consist of at least 90 per cent. of specimens of good red colour for the variety.

Striped or partially red varieties, such as Cox's Orange Pippin, Delicious, Nickajack, Rome Beauty, &c., shall, when such varieties are not less than $2\frac{1}{2}$ inches in diameter, consist of at least 50 per cent. of specimens of good red colour for the variety, and, if less than $2\frac{1}{2}$ inches in diameter, shall consist of at least 75 per cent. of specimens of good red colour for the variety.

Yellow or green varieties, such as Cleopatra, Dumelow's Seedling, London Pippin, or Newton Pippin, shall consist of specimens of characteristic colour for the variety.

Grade B.

All apples in this grade shall consist of specimens of not less than $2\frac{3}{8}$ inches in diameter. Wholly red or striped or partially red varieties shall consist of at least $33\frac{1}{3}$ per cent. of specimens of good red colour for the variety. Yellow or green varieties shall consist of specimens of characteristic colour for the variety.

Grade C.

All apples in this grade shall consist of specimens of not less than $2\frac{1}{4}$ inches in diameter. No colour requirements are needed for this grade, excepting that specimens shall not be clearly immature.

Grade D.

Shall consist of specimens of not less than 2 inches in diameter, and packed in accordance with the general requirements of these Regulations, viz:—That the outer layer or shown surfaces of the fruit contained in the package shall be so packed that they shall be a true indication of the average grade of the whole of the fruit contained in such package.

No colour requirements are needed in this grade, excepting that specimens shall not be clearly immature.

Notwithstanding anything to the contrary, normally small varieties such as Fameuse (Pomme de Neige), Yates, Summer Pearmain, &c., shall be allowed in any grade if the specimens in such varieties are not less than the following diameters:

1. Grade A.—$2\frac{1}{4}$ inches.
2. Grade B.—$2\frac{1}{8}$ inches.
3. Grade C.—$2\frac{1}{4}$ inches.
4. Grade D.—2 inches.

The California "diagonal method" of packing, now so widely advocated and generally adopted, is a wonderful improvement on the haphazard method originally practised. The former is also known as the "numerical pack," because, when properly arranged, according to the size of the fruit, in the 2 x 1, 2 x 2, or 3 x 2, &c., formation as the case may be, the number in the package may be easily computed by multiplying the number of apples in a tier by the number of tiers in the case. In the "numerical pack" each apple is placed in a "pocket" and, consequently, there is no direct pressure on any apple to cause bruising. The general adoption of paper wrappers has also assisted materially in reducing to a minimum the bruising of fruit in transit to the home markets.

With a view to establishing a uniform method of marking packages containing apples for market, the regulations under the Fruit Act prescribe as follows:—

> The package shall be marked legibly and durably in letters of not less than one-quarter of an inch in length, with a designation of the grade ("A," "B," "C," or "D," as the case may be determined or prescribed) of the fruit therein contained.

The employment of attractive cases made of clean, seasoned wood cannot be too strongly recommended. No matter how perfectly the grading and packing be carried out, if fruit be put up in dilapidated or unattractive packages, an unfavorable impression regarding the contents is created in the minds of intending purchasers. This applies particularly to fruit for export to the Home markets, where we benefit by practising the methods adopted by the fruit-growers of other countries in which this detail receives very special consideration.

Conclusion.

The matter of repatriating a large number of soldiers as orchardists is now occupying the attention of authorities interested in this matter. These new fruit-growers—some of them not previously experienced in the work—are being assisted to acquire an aptitude for it. The necessity for this becomes more apparent when we consider that post-war factors, now only dimly foreseen, may become actual. It is reasonable to assume that the only way to sustain the burden of the debt of taxation after the war is by enlarging the fabric of national wealth Fruit-growing is one of our staple industries, and, if our oversea trade expands as it should, one where the possibility of extension is great. But it is an industry that can be carried on profitably and in the best interests of the State, only by the orchardists possessing a high standard of horticultural knowledge, and by the application of constant and strenuous toil.

The Department of Agriculture and the orchardists realize that the success of the fruit-growing industry is largely due to the dissemination of technical knowledge concerning its numerous phases. It is hoped that the higher standard of horticultural education recently inaugurated will help to consolidate past achievements and ensure the future prosperity of the industry. The province of the Orchard Supervision Branch is being gradually enlarged so as to enable the officers to deal comprehensively with the business as a whole, and they are also afforded

an opportunity to diffuse much information by lectures and demonstrations at farmers' classes. Another factor which has helped our fruit-growing industry is the complete information on all its phases disseminated by the press.

Fruit-growing constitutes the principal feature in the curriculum at the Burnley School of Horticulture, where the most scientific methods are introduced into the practical work by experts who have specialized in the cultivation of the different kinds and varieties of fruits. Provision is also made at the Dookie Agricultural College and other similar institutions for the teaching of this subject.

Victoria has always maintained a high standard in fruit-growing, and this position should be upheld, so that the friendly rivalry existing between the States may continue and benefit the Commonwealth as a whole.

BEES AS AGENTS IN PLUM POLLINATION.

Bulletin No. 274 of the College of Agriculture, Agricultural Experiment Station, University of California, contains an account of an experiment carried out in the Santa Clara Valley, and which forms part of a series undertaken to determine why, under certain conditions, some plums bear abundant crops and under other conditions bear light crops or none at all.

In a large orchard two pairs of adjacent French and Imperial plum trees, as nearly as possible of the same age and size, were enclosed in a tent of white mosquito net, so as to exclude all insects. In every other way the trees were under the same conditions as the other trees in the orchard. The tents were put up before any of the blossoms opened, and taken down when there was no longer any danger of outside pollination. As soon as 25 per cent. of the blossoms had opened a hive of bees was placed under one tent, and kept there throughout the blossoming period (about five days). The bees seemed to prefer the flowers of the French plum to those of the Imperial plum. The results showed that the French plum under the tent with the bees set a much higher percentage of fruit than the other trees. The crop obtained from the Imperial plum under the tent with the bees was light, and could not be accounted for, and it is intended to carry out further experiments to determine the cause.

The results show the honey bee to be one of the most important factors in carrying pollen from one tree to another. The most satisfactory method of introducing bees into orchards has not yet been decided, but it seems that the best results are to be obtained by placing about one hive to the acre during the blossoming period, after which the hives could be removed.

POULTRY REARING.

The Equipment of the Poultry Farm.

By A. V. D. Rintoul, Assistant Poultry Expert.

Maximum efficiency, within reasonable limits of expenditure, should be the key to the design of any well laid-out and equipped poultry farm. It is of considerable importance for the poultry farmer to decide at the start the extent to which he hopes or intends to develop ultimately, in order that a sketch may be made of the plant at its full capacity and designs made of the shedding immediately required.

Letters are continually being received inquiring for plans of buildings for poultry, but no standard design has been adopted by the Department of Agriculture, for the reason that the materials available in Victoria are so varying that no standard could be followed with any faithfulness.

The war was responsible for a considerable outburst of energy on the part of poultry-keepers to secure all sorts and conditions of material for sheds. Corrugated galvanized iron rose from about 4d. per foot new to nearly 1s. 6d. a foot second hand, usually with three rows of nail holes—a price at which obviously it did not pay to use. Kerosene and petrol tins, after useful service in various directions, were cut, flattened out, and fired, to remove the tin from them, and were eagerly sought by poultry-keepers, who paid about 8s. per 100 up to fully £1 per 100 for them. Drums, which had contained calcium carbide, were also used after being cut and flattened, the usual practice being to dip either these or the petrol tins in boiling tar to prevent rusting.

Everything in connexion with poultry foodstuffs and equipment rose enormously, in many instances out of all proportion to legitimate increased cost, and the price of eggs remained stationary through the incompetence of the breeders and egg-producers to co-operate and gain what they were entitled to.

In some parts of the State split or sawn hardwood palings may be used to advantage. The sawn palings are the best, as they are cheaper and less liable to harbour vermin than the split palings. In sandy districts the cheapest material would probably be cement bricks. Eight parts sand should be used to one of cement, care being exercised so as to get the mixture neither too wet nor too dry.

To refer again to the question of planning out the accommodation, certain general principles must be observed. Due regard for the ultimate extension must not be overlooked, and labour-saving methods and appliances should be adopted wherever practicable. The greatest weight should obviously be carried the least distance, consequently the big laying sheds should be as near the feed and egg room as possible, with the smaller and single pens further off. For the poultry farmer on a big scale the laying down of a small trolley line of hardwood rails will mean a saving of labour, and where there is an ample water supply it is an economy to adopt the ball-cock system connected with each pen. With guttering at normal prices, a tap may be used just dripping into the guttering which is carried past each pen, but provision should be made for cutting out any pen where sickness may arise, so as to prevent the water supply becoming a source of infection for the rest of the flock

Plans should be made for the following sheds:—Feed store and mixing, egg room, incubator shed, brooder shed, movable chicken colony houses, breeding pens, single test, and laying sheds.

The feed store should be made rat and mouse proof, and rather on the large side, so that when opportunities occur stocks may be purchased on a bigger scale than just "hand-to-mouth."

The egg room should be as airy and cool as possible and well protected from the north. Plenty of shelving should be provided.

The incubator shed.—This should really take the form of a cellar. The small style of incubator has now virtually had its day, and the mammoth type of machine is becoming more and more popular; in fact, a big incubator represents a very sound investment for those in a position to purchase one. Coke is the only fuel required, and 20s. worth of coke would run a 15,000 egg machine for three weeks. The recognised charge is £1 for 150 eggs, so that the 15,000 machine would earn £100 every three weeks; accordingly, a very good living could be made by only running the machine for five months in the year. The cost of installing such an incubator would not be greater than the capital required for a 1,000-bird farm.

The brooder shed should face north, whilst the other sheds for the birds face east. Chickens occupy the brooder shed only at such times of year as all available sunlight is required. For the poultry farmer on a decent scale, the colony brooders are an undoubted advantage, and, in addition, are economical on fuel. At the same time, the small poultry keeper, hatching out only a 100-egg machine per week, will be able to manage with the smaller brooders, the heating of which may be supplied by hot-water pipes, gas, electricity, or even feather pillows.

Portable colony houses for the growing chicks are really a necessity, as it is a terrible mistake to imagine that fowls can be reared year after year in small back yards, as is at present, unfortunately, an all too prevalent belief. Sooner or later this practice will result in a marked depreciation in the constitutional vigour of the birds.

The breeding pens should allow more than the regulation 4½ to 5 square feet of floor space per layer, and should be fitted with outside runs, so that during the breeding season the stud stock may be placed in the open for a time, at any rate, each day.

Single test pens may be built 5 feet deep by 3 feet frontage, the door forming the entire front. These sheds are useful for more reasons than merely determining the exact number of eggs a bird lays in a given period. The shape and size of egg may also be ascertained; the pens used for small special matings, &c., &c. Pens 5 feet by 3 feet will, at a pinch, hold four birds temporarily, although three are preferable. Birds of similar pedigree which are not to be single-mated can be run in these pens, if required, for trios, &c., during the breeding season.

Laying Sheds.—These are to accommodate the bulk of the flock, consequently all labour-saving devices should be carefully considered. Whilst the practice of running large flocks together tends to reduce the labour, it is an undoubted fact that better returns are more readily obtained from smaller mobs. The birds seem to lay better and can undoubtedly be more easily supervised in small numbers. In every flock there are a proportion of both greedy, and also shy, feeders, and it is an advantage to try to pen birds of similar habits together. These sheds should face east, and be covered up for about 3 feet from the ground in front.

On a properly managed poultry farm some system of bookkeeping is essential. The simpler the system adopted the greater the likelihood of the transactions being entered regularly and accurately. The principal expenditure is incurred by purchase of foodstuffs, and the main source of revenue is from the sale of eggs. Accounts should be kept showing purchase of foodstuffs, materials bought for repairs and renewals (apart from new buildings, which are a charge on capital account and not current account), fuel or power used for heating incubators, brooders, or working machinery, cartages and freights, advertising, labour, &c., and on the credit side the sale of eggs, market birds, and stud sales. *The net profit is the surplus after all expenses have been paid, including interest on capital or on loans.*

Incubation of Eggs.

There are virtually three methods by which hatching may be effected, *i.e.*—(1) Natural Method; (2) Semi-Natural Method; (3) Artificial Methods.

The first method—Natural Hatching—is when a hen steals her nest, and hatches out her own eggs, almost invariably with the utmost success, whereas in the second (semi-natural) method the hen is set, when broody, on eggs not necessarily laid by herself, and in a place chosen by man. The nest should be made in a place apart from the general flock, and the sitting hen should be given plenty of fresh, cool, drinking water (as broodiness is a feverish condition) and provided with a good dust bath to keep herself clean from vermin, which, if undestroyed, would materially retard the growth and welfare of the chickens when hatched.

It is desirable to keep a record of each hen to show such data as, when set, date hatch is due, number of eggs set, number fertile, and result of hatch; also the pen number from which the eggs came. The first test should be made between the fifth and seventh days, when the embryo may be readily detected, and the commencement of the blood vessel system is also noticeable. By setting, if possible, three hens at once, it is generally easy to re-group the fertile eggs, and so enable one of the hens to start off again on a fresh lot of eggs.

The second test may be made between the twelfth and fourteenth days, when the bulk of the eggs appears dark and the air space of the egg—about one-fifth—is plainly visible. The hen must not be disturbed after the nineteenth day, and hatching should be completed by the twenty-first day. The reason why better results may be expected from the purely natural method is because the hen has mated with the rooster when in the best condition for breeding, and also because she is frequently a better judge of the choice of nest and conditions than man is.

Artificial Hatching.

Hatching by artificial methods has been known to exist, albeit under somewhat primitive conditions, for about 2,000 years, some of the earliest work in this direction being traceable to China, where there are three types of incubators—the mud-plastered, the straw-covered, and the muslin-covered. The first two types are more common in the country and village districts, whilst the third finds favour in the town hatcheries.

The mud type, which is the most primitive, is shaped like an ordinary barrel, 36 inches high, and 24 inches in diameter. The framework is of clay or mud bricks, plastered inside and outside with mud, and on top of the incubator is an opening which permits an inverted bell-shaped receptacle to fit in. About 12 inches from the bottom of the machine there is an aperture on the side which serves as a furnace door. Charcoal supplies the necessary fuel for heating. The eggs are placed, when ready, in a basket, which is put into the receptacle at the top.

The second type of incubator is similar to the first in shape and size, but the materials used are different. The body, or framework, is an earthenware receptacle, the external part being a straw-woven mat, which serves to retain the heat.

The third one, the muslin-covered, is the simplest of the three in structure. The body is a sugar barrel, 3 feet high, 2 feet in diameter. The interior is well padded with felt or muslin, and the cover or lid is likewise padded. The heat is supplied by a stove, 6 inches in diameter, 7 inches high, wider at the top, and narrower at the base. Charcoal is used, and a sliding door controls the amount of air. The compartment in which the incubators are located is also heated, the object being to secure a uniform temperature sufficient to enable the eggs to be removed from the incubator on the fourteenth day. The capacity is roughly 400 to 500 hen eggs, 300 to 350 duck eggs, or 150 goose eggs.

Placing the Eggs in the Machine, etc.

When the incubator is at the desired temperature a piece of muslin 30 inches square is placed on the table, and the eggs, after being tested for "cracks," are put on the muslin. The four corners of the muslin are then brought together, and the eggs are gently lowered into the incubator, the edges being folded so as to cover the surface of the eggs. The second and subsequent layers are prepared in like manner, the number of layers depending on the capacity of the barrel.

The reading of the temperature is an art which the Chinese poultrymen have developed. The ordinary incubator thermometer is unknown to them. To determine the temperature, three or four eggs are taken out and pressed against the eye of the operator. (This system has been found admirable by some Australian poultry-men for determining the eggs which contain live chickens on the nineteenth day of incubation. The air chamber end of the egg rapidly cools outside the incubator, and a marked increase will be noted in temperature against the eye at the lower end of the egg, if it contains a live chick.)

The eggs are turned three or four times daily. The lid is taken off the incubator, and the first layer put in a bamboo tray. The eggs are turned by pressing the palms of the hands over them. This layer is then transferred to an adjoining incubator, and the process continued until all the eggs are turned and placed in the second incubator, the top layer in one incubator being in consequence the bottom layer in the other.

Testing takes place on the fourth day, a small hole being cut in the wall of the room, and the eggs are "candled" against the sun. The infertiles are then sold as "fresh."

Between the fourteenth and seventeenth days the eggs are removed from the incubator, and placed on the shelves on round trays, and left until hatched.

Egyptian Methods.

The Egyptian system is also of great antiquity. Large rooms are used with a passageway down the centre, and on the floor of the compartments eggs are stacked in considerable heaps. Heat is supplied from briquettes of pressed camel dung burning about 5 feet from the ground on shelves. The eggs are rolled by hand (a better system than that of turning usually practised, even by experienced men), the men of one district (Berea) being specially skilled in this work, and with such keenly-developed, sensitive powers, that bad eggs can be at once recognised by touch. The actual hatching percentage cannot be stated, but it is known that it is not high.

European Methods.

The first incubator known in Western Europe was that shown in 1851 at the International Exhibition by Mons. Cantello. Its method of construction was as follows:—A tank was filled with hot water, and was fitted with india-rubber on the under surface of the bottom in direct contact with the eggs. The sagging of the india-rubber pressing on the eggs brought about a complete failure, and it was not until 1878 that Monsieur Roullier-Arnoult, principal of the French Department of Agriculture Poultry Farm, at Gambais, introduced an effective machine. The arrangement in this incubator was to put water in a tank and to draw off a portion of it every few hours and in its place pour in a similar quantity of boiling water. There was no lamp, nor regulator, yet 66 per cent. was about an average hatch. Some machines of this type are still in use. Five years later, Mr. Charles Hearson patented the machine which bears his name, and for cooler latitudes, there is probably still no better machine. Hearson added the lamp and capsule for regulating the heat.

There are now two main systems of incubation—(*a*) hot water or tank machine type; and (*b*) hot air machine. In the hot water type, the heat is supplied by radiation from the bottom of the copper tank containing water heated by kerosene or gas. In the hot air type, the heat supplied is a downward current of hot air, generally obtained from kerosene or gas; although lately an excellent machine, heated by radiation from electrically-heated resistance wire, has been put on the market by a Victorian. This latest type, where electric power is available at about 2d. per unit, is the cheapest as far as cost of heating is concerned, and the initial cost of the machine is about the same as most others. This and some other kinds have a "cut-off," which reduces the cost of heating; other types merely allow the heat to escape, but do not reduce the consumption of current. Preference for any one type is a matter for the individual operator, who had always better be master of one type than the slave of several; yet, far too many breeders have a motley collection of all types and sizes.

In warmer latitudes the objection to the tank machine is that it cannot be easily cooled during the day time in a warm spell, nor quickly heated on a cold night. For this reason, north of the Dividing Range, the hot air type is generally preferred, though in the Gippsland and Western Districts, with their cooler climates, the tank machine is excellent.

There is little doubt that the mammoth type of incubator will gradually supersede the small machines, on account of the greatly

reduced cost of working, and this work is likely to be specialized. The average poultry-farmer has usually quite enough work to do as it is, and would gladly avail himself of the services of a reliable mammoth hatchery.

Composition of the Egg.

The composition of the egg is as follows:—

Water	66.7 per cent.
Protein..	12.2 per cent.
Fat	8.9 per cent.
Ash	12.2 per cent.

It will, therefore, readily be seen that the water content is very high—about two-thirds of the total—but the heat supplied during hatching serves to evaporate a considerable quantity, and on this account, in dry atmospheres, the air in the machine must be moistened to prevent too great an evaporation of the moisture in the egg. This is the only reason for the supply of moisture in the incubator. In most of the hot-air types of machines, the hot air is driven down over the eggs, and escapes underneath; consequently, it is a mistake to have the water under the eggs; it should, undoubtedly, be above the eggs, so that the hot air may be moisture-laden when passing over the eggs. The eggs need not be turned during the first forty-eight hours; but after that, turning should be carried out twice a day, and the eggs cooled once a day till the nineteenth day; after which the machine should be shut up until the hatch is complete. Much harm is done by opening the machine "just to have a look," for in this way the membrane inside the shell is dried and toughened, and increases the chick's task of breaking through.

Best Eggs to use for Hatching.

The eggs set in the incubator should be of as nearly an even age as is possible, and preferably not over seven days' old. Those with uneven ends or bands are unlikely to hatch, and, therefore, should not be used. It is impossible to detect with the naked eye either fertile or infertile eggs, even when broken open, but an instrument from America is now on the market which is expected to indicate, to a certain extent, the hatchability of eggs, based more or less on specific gravity. No machine yet invented can determine fertility, although the claim has occasionally been made.

It is generally believed that the denser the albumen the more nourishment there will be for the developing embryo, and, consequently better prospects of a strong, hardy chicken, but as a moderately dense albumen with a very thick, strong shell would give a similar specific gravity reading to an egg with denser albumen but thinner shell, the tests now being made are likely to be somewhat inconclusive. After the moult the eggs are richest in albumen, which is gradually reduced as the season advances, and there is usually a higher percentage of cockerels in the earlier hatches, but this alone does not necessarily prove that denser albumen means a majority of cockrels.

In nature, it is generally noticed, by the observant breeder, that the sex of offspring usually favours the parent who is in the greatest danger of extermination. Those hens which go bare and red about the head and face, and which are very hard in feather, only moulting odd feathers at a time, and laying almost throughout the year, will generally give in the autumn a fairly high percentage of females. On the other hand, the hens which have gone through a complete moult, and have come into full vigour, will show a majority of cockerels in the earlier hatches. The problem of sex control is of such vast importance that it merits the most thorough investigations, as in the light breeds the cost and labour of rearing cockerels are barely balanced by the market returns.

Development of the Embryo.

During the first day there are two growth centres, the head process and the primitive streak, the latter appearing in the blastoderm in the axial line of the future embryo, but somewhat behind the place where the embryo proper begins to develop. In the head process there is the first development of the spinal nerve, as well as a rod of cells termed the notochord, which form the supporting and stiffening axis of the body, and there is a thin membrane termed the amnion (or caul), which forms a closed sac surrounding the embryo.

The second day the head continues to develop rapidly, and the formation of blood vessels begins, the heart being formed within the head fold, with vitelline veins and vitelline arteries. Two swellings from the brain form the first trace of the optic system, and the ears are represented by two slight depressions where the hind brain will ultimately develop.

The third day marks the commencement of the internal organs, with a considerable reduction of the white of the egg, caused by the increased activity of the blood-vessel system.

The fourth day the white, or albumen, of the egg is further reduced, the wings and legs appear as conical buds, the kidney is also developed, and the amnion is fully formed and completely surrounds the embryo. By the fifth day the legs and wings have increased in length, although they are still very much alike.

The sixth day the avian characteristics have developed in the legs and wings, head and alimentary canal. Hitherto there has been little distinction from the embryo of mammals or reptiles.

The seventh day the head ceases to grow more rapidly than the body, and motion becomes apparent. Feathers begin to appear on the ninth day, but do not protrude until the thirteenth day.

The beak appears on the eighth day, and by the sixteenth day the beak and nails have hardened. By the fourteenth day the chicken changes its position from lying at right angles to the axis of the egg, and thereafter lies lengthways. By the twentieth day the chicken pierces the inner shell membrane, and commences to breathe air, consequently the allantois circulation gives way to that of the lungs. The twenty-first day the chicken hatches, prior to which the remainder of the yolk is absorbed, providing sufficient nourishment for about 24 hours or so.

MANURING FOR PROFIT.

Results of Experiments in Potato Cultivation.

(*J. T. Ramsay, Potato Expert.*)

Manures judiciously used—to the farmer—are analogous to quick maturing loans bearing a high rate of interest. That fact is becoming more generally accepted as time goes on, and the business method of advancing capital to the soil in the form of manures for crop is becoming, not only more widely practised, but more liberal in its application.

The results of this season, both on the farms of potato growers and in the experimental fields conducted by the Department of Agriculture, again give substantial proof of the benefits of the judicious application of manures, alike to the crop and the grower.

At Lake Tyers, on the property of Messrs. C. Hendrie and Sons, an area was planted with potatoes of the Arran Chief variety in February. Variation in manurial treatment was made over five sections, for purposes of comparison. The scope of the experiment was limited by the fact that no potash was available for inclusion in the trials. The nature of the soil was sandy loam, not naturally rich, but of nice physical character. A favorable season was experienced, and the crop developed well, the necessary cultivation being given by Messrs. Hendrie as circumstances demanded. The method of applying manures was to broadcast these on the surface of the ground immediately before the ground was ploughed and planted.

Harvesting took place on 28th May, and the table given on page shows the results obtained.

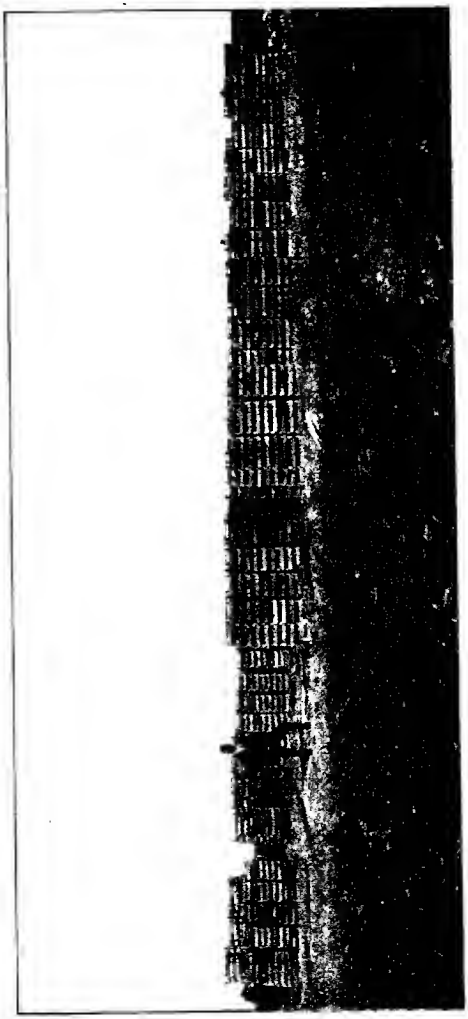
MANURIAL TRIALS AT LAKE TYERS, 1919.

Manures	Yield per acre.	Tonnage increase per acre from Manures.	Value per acre of Manures	Value of crop per acre at £5 per ton.	Net cash increase per acre after deducting cost of Manures.
	tons cwt. qrs. lbs.	tons cwt. qrs. lbs.	£ s. d.	£ s. d.	£ s. d.
I. 5 cwt. Bone and Super.	4 3 0 0	1 12 0 0	1 12 0	20 15 0	6 7 6
II. 5 cwt. Super. ..	4 3 0 0	1 12 0 0	1 10 0	20 15 0	6 15 0
III. 10 cwt. Bone and Super	9 1 0 0	6 10 0 0	3 10 0	45 5 0	29 0 0
IV. 10 cwt. Super. .. 1 cwt. Ammon. Sulp.	7 3 0 0	4 16 0 0	3 10 0	36 5 0	20 0 0
V. No Manure ..	2 11 0 0	..	Nil	12 15 0	..

Results like these require but little comment. Two striking facts are prominent:—

1. Substantial profit accrued from investment on manures.
2. Since less acreage need be worked to produce a given quantity of produce, liberal manuring economizes time and labour.

At Cashmore, Portland, experimental work was continued on the farm of Mr. G. A. Taylor. There are two main classes of soil on the



A New Phase of Victorian Potato Cultivation.

Cashmore heath. One of these is a grey, sandy soil, which responds to manuring, and the other a dark sandy loam, which up to the present has proved quite useless for cropping.

Planting took place in November, 1918, and harvesting in June, 1919.

The procedure at Cashmore was similar to that practised at Lake Tyers, viz., the land was well worked, manures applied to the surface soil broadcast, and ploughed down with seed.

A varietal test of five varieties was included on this field, together with a manurial trial on Purple Top swedes.

The peat applied in section II. of the plots was obtained from one of the many small peat holes occurring throughout the district. The tabulated results are given hereunder:—

CASHMORE GREY SOIL, 1918-19.

Weights per Acre.

Manures.	Brownell's.		Seedling.		Carmen I.		Up-to-date.		Clark's Main Crop.	
	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.
I. No manure	5	6	2	4	2	6	2	2	4	28
II. Twelve loads peat ..	6	6	3	14	3	10	3	14	4	14
III. 6 cwt. bone and super. ..	7	4	3	18	3	8	4	0	5	8
IV. { 6 cwt. bone and super. .. / 1 cwt. ammon. sulph. .. }	7	0	5	2	6	0	5	12	6	18
V. No manure	4	4	1	10	1	16	3	2	4	10
VI. { 6 cwt. basic phosphate .. / 1 cwt. ammon. sulph. .. }	4	12	3	2	4	6	3	16	5	10
VII. 1 cwt. ammon. sulph. ..	5	2	3	6	3	14	3	14	5	0
VIII. 6 cwt. basic phosphate ..	4	18	1	1	1	10	1	10	3	12

CASHMORE RESULTS IN MONEY VALUE PER ACRE.

Average of Five Varieties Tested.

Manures.	Yield per acre.				Value of Cost at £5 per ton.			Cost of Manure.			Cash value per acre increase after deducting cost of Manures.		
	tons.	cwt.	qrs.	lbs.	£	s.	d.	£	s.	d.	£	s.	d.
I. and V.—No manure ..	3	1	0	0	15	5	0	Nil.			Nil.		
II.—12 loads peat	4	8	0	0	22	0	0	2	8	0	4	7	0
III.—6 cwt. bone, 1 super. ..	4	16	0	0	24	0	0	1	19	0	6	16	0
IV. { 6 cwt. bone and super. .. / 1 cwt. ammon. sulph. .. }	6	2	0	0	30	10	0	2	19	0	12	6	0
VI. { 6 cwt. basic phosphate .. / 1 cwt. ammon. sulph. .. }	4	4	0	0	21	0	0	2	7	0	3	8	0
VII.—1 cwt. ammon. sulph. ..	4	4	0	0	21	0	0	1	0	0	4	15	0
VIII.—6 cwt. basic phosphate ..	2	10	0	0	12	10	0	1	7	0	4	2	0

As in the Lake Tyers tests, the manures, with one exception, again show a marked improvement in the yields obtained per acre. This exception was submitted to the Chemist for Agriculture, who explains the decrease from the use of basic phosphate in this soil by stating that everything points to a most unusual effect on the part of basic phosphate.

Practically similar results were obtained by these manures on Purple Top swedes.

RESULTS OF MANURIAL TRIALS ON SWEDES.

	tons.	cwt.	qrs.	lbs.
I.—10 loads, stable manure ..	10	0	0	0
II.—12 loads peat	8	4	0	0
III.—6 cwt. bone and super ..	10	4	0	0
IV.—6 cwt. bone and super .. 1 cwt. ammon. sulph. ..	16	0	0	0
V.—No manure ..	1	8	0	0
VI.—6 cwt. basic phosphate .. 1 cwt. ammon. sulph. ..	1	12	0	0
VII.—1 cwt. ammon. sulph. ..	10	8	0	0
VIII.—6 cwts. basic phosphate ..	0	16	0	0

VARIETAL TESTS.

Leongatha.

Variety.	Yield per acre.			
	Tons.	cwts.	qrs.	lbs.
Carman III.	4	10	0	0
Scottish Triumph	4	4	0	0
Factors	4	0	0	0
State of Main	4	0	0	0
Coronation	3	18	0	0
Brown Rivers Selected	4	0	0	0
Brown Rivers Ordinary	3	0	3	0
New Zealand Pink Eye	3	10	0	0
Early Norther	2	14	0	0
Manistee	2	12	0	0

Cashmore.

Variety.	Yield per acre.			
	Tons.	cwt.	qrs.	lbs.
Brownell's	5	12	0	0
Clark's Main Crop	4	16	2	9
Up to Date	3	9	0	0
Carman I.	3	6	0	0
Seedling	3	0	0	0

It should be noted that in working out comparative values of crops produced by various manures, the rate per ton has been taken at £5. As a matter of fact, a much stronger case for manuring could be made if

the average price for this season (approximately £10 per ton) had been used. But it is obvious, even taking the lower rate, which is a fair average one over a number of years, that the liberal use of fertilizers is a sound policy for the potato-grower.

While not strictly within the experimental field, the achievement of Mr. J. Gibson, of Dalmore, is probably so near to a Victorian record that mention of it should be made.

Out of a total farming area of 100 acres, Mr. Gibson planted 75 acres with potatoes. The variety mainly grown was Carmen I. The soil on this farm is some of the best at the Dalmore end of the Koo-wee-rup Swamp. Mr. Gibson closely followed the practice, constantly advocated by this Department, in the matter of using only good seed and adopting the boxing system of storage for same. Manuring was done at the rate

Planting Machine designed by Mr. J. Gibson, of Dalmore.

of (approximate) 6 cwt. nitro-super. per acre. No effort was spared in tending the crop during the period of its growth.

The result was an average crop over the whole area of about 9 tons to the acre. This, coupled with the high selling price obtaining this season, is palpably a most profitable achievement. A feature of this case is the fact that practically all of the work in planting and growing the crop was carried out by the grower himself, with little assistance.

An illustration is given of the planting machine designed by this grower, and used exclusively in planting his 75 acres. The illustration is self-explanatory.

In potato cultivation, as in any industry, specialization is the keynote of success. Haphazard methods must eventually disappear before those which give as near to a guarantee as it is possible to have in farm practice.

True agricultural progress is to be secured by making acres produce more, rather than by making more acres produce.

PIONEER SETTLEMENTS IN DISTRICTS OF HEAVY RAINFALL.

THE TOLMIE DISTRICT.

H. A. Mullett, B. Ag. Sc., Science Field Officer.

Perhaps the most striking feature about the settlement of Victoria in the drier areas is the comparative ease with which the farmer has been able to clear his land of virgin timber and maintain these improvements over unlimited areas in good condition. As a rule, provided the land is well stocked with sheep, the tendency for the timber to re-establish itself, so pronounced in more humid regions, never gives the owner a moment's anxiety. The tendency is there all the same, as is shown by the growth of young native trees on certain enclosed and unoccupied areas, but on the settled country, grazing, and particularly cultivation, are the silent yet powerful factors which keep Nature subdued. Both the farmer and the grazier are thus fortunate that where either of these simple rural industries can be profitably carried on they will at the same time keep land free from timber and undergrowth.

In Moist Hill Country Active Measures are Necessary to Maintain Pastures Productive.

On the other hand how different is the lot of the settler in districts where the rainfall is 35 inches and over annually—more especially in the heavily timbered hill country. Here constant attention is necessary to keep the land free from undergrowth, and to maintain the pastures in anything like a productive state. Indeed, far from merely turning stock loose on the cleared land, the systematic sowing down and the grazing of some good artificial grass is a fundamental necessity for the provision of feed and the suppression of undergrowth which springs up quickly after the original timber has been ringed or fired. Even when this is done constant renovation of the pastures is necessary; the best method where the slopes of the land and other circumstances will permit it, is the growth of some annual crop in systematic rotation over the farm, involving the occasional use of the plough and the re-sowing of successive portions of the pasture at intervals of five or six years.

Apart altogether from the general disabilities under which the settlements in these districts have laboured, such as bad roads, ravages of vermin, losses from bush fires, high cost of clearing, &c.—all of which have been most serious—it cannot be denied that failure to recognise these cardinal agricultural differences between the moist and the dry districts is partially responsible for the non-productive condition of many of the holdings in question. Thus the settler who ringed a wider timber area than he could sow down to artificial grasses or could bring under the plough, merely succeeded in encouraging a tangled growth of saplings and bracken much more barren of feed and difficult to reclaim than the original timber. The man who leased the block abandoned by his neighbour and threw over the plough in an attempt to make an easy living by grazing both of the blocks with cattle was soon forced out of the business by the rapid deterioration of the pastures.

Accepting the fact that the other disabilities referred to are the main factors which limit real progress, all endeavour should be centred as long as they exist on adjusting the methods of farming to minimize their effects. If it costs from 25s. to 35s. a ton to cart potatoes 15 miles from a settlement to the station, then efforts should be made to divert the labour expended in producing the potatoes, and particularly the extraordinary energy required to cart them to the railway, into some other and more profitable channel.

Peas, barley, maize, and potatoes, all of which may be grown in these districts, can be readily converted, for instance, into pork, a highly concentrated and valuable product which furnishes its own means of transport.

The problem of dealing with vermin, particularly rabbits, is a more difficult one to solve in the case of the struggling pioneer with a limited capital, but there is the danger of his sitting down and accepting the pest as some natural phenomenon, and like the rain or the seasons, beyond the power of man to control. The serious losses to sheep from wild dogs need not occur; if the sheep cannot be yarded at night cattle should be substituted.

It should go without saying that, in the face of so many natural difficulties, special pains must be taken to insure the maximum yields from each crop and each head of stock, and each acre of grass. In the case of dairy cows, the culling of the non-productive ones, the breeding of better ones, and the provision of extra feed, particularly concentrates in times of need, must be systematically practised. The crops cultivated must be suitable and the soil carefully prepared and manured. Grass paddocks should be carefully sown, renovated, and manured.

The hill country of Victoria is scattered with these settlements, some of them have been settled for many years; some have been opened up within the last decade. Among the settlers are those who have adopted rational methods and those who have not. The latter class are being slowly squeezed out and their abandoned holdings covered with scrub and infested with vermin, and always ready fuel for a bush fire, do not lessen the difficulties of the remainder. Tolmie, in the parishes of Toombullup and Dueran, in the north-east of Victoria, is a case in point.

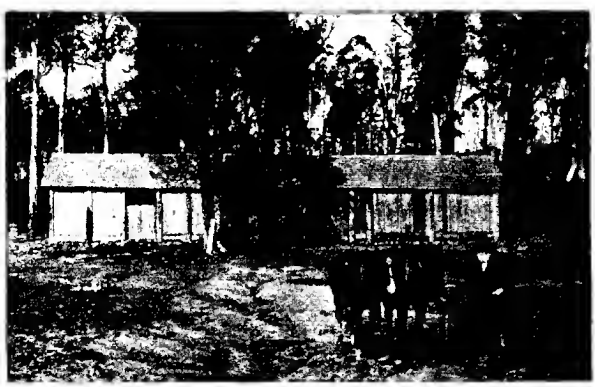
Tolmie Settlement.—Soils and Climate.

Tolmie is situated on a broken plateau, right on the hill tops at an elevation of some 2,000 odd feet above Mansfield, and 13 miles distant. There is very little level country in the settlement. The tops of the ridges are capped with a deep friable volcanic loam. It is highly fertile. Lower down are lighter chocolate loams, and in the valleys and flats are found firm greyish soils overlying old sandstone. The two friable soils grow excellent crops of potatoes, but native grasses do not become established on them as readily as on the grey.

Good summer rains are received and the grass remains green the year round. This is what attracted the earliest settlers, who, during serious droughts on the wheat lands of the Goulburn Valley over 40 years ago, worked their way up the river in search of feed for stock. The green grass was to them a sign of the promised land. The area was first thrown open for selection after the Kelly outlaws had been suppressed. They had friends in the vicinity, and it was desired to introduce fresh blood into the community.

The winters are severe; usually the ground is covered with snow for a week or so annually, and during that period, at any rate, stock must be hand fed. For many years the settlers hauled their produce laboriously over the steep worn road to Mansfield—a trip which took two days to get a loaded waggon there, and required about three horses to each ton. Recently, however, the Country Roads Board has constructed a new well-graded road, which will considerably reduce the cost of haulage, while another road has been authorized, linking up the settlement with Whitfield, 25 miles distant.

The new roads have considerably raised the spirits of the remaining selectors, and it behoves them, in keeping with the brightened prospects, to critically examine their present methods in the light of their past experience with a view to eliminating all practices that are not sound. The results achieved by one of the settlers, Mr. T. Reynolds, along lines new to the district, though well known elsewhere, are certainly very suggestive of what might be done at Tolmie, and are worthy of careful examination in an impartial manner by those most interested.



Horses and Stable—Mr. Stewart's block.

Present Methods.

The present style of farming may be fairly typically exemplified by that of Mr. J. Stewart, a settler of 30 years standing. Mr. Stewart's selection consists of 280 acres of second-class land, but in addition a further area of 250 acres is rented This is an abandoned section heavy with suckers, and is to be had merely for paying the rates and keeping the rabbits in check. Mr. Stewart has not made the common mistake of trying to develop this block as well as his own.

The cultivation is confined to 15 acres of potatoes and to 15 or 20 acres of tartarian oats for hay. The stock comprise a dozen milking cows, five horses, and from 30 to 40 head of young cattle, but these at times receive grazing, in addition to that available on the two blocks. These are kept for two or three years and then sold as stores. They improve rapidly when they get on to better country. The hay is used to feed the stock during the winter, and sometimes maize is grown to supplement the summer feed of the dairy cows.

Mr. Stewart does not keep sheep, because the "dogs" are too troublesome, and the ravages of rabbits were very severe until the block was securely netted. He admits making the mistake years ago of ringing more of the original timber than he could keep clear. This area rapidly became overrun with saplings, with the result that it furnished considerably less feed than there was between the trees of the virgin forest.

Mr. Stewart states that flax has been grown in the district, and has done well. On his block the homestead, stable and cow-shed, of split timber, roofed with shingles, and other improvements, show splendid workmanship.

Mr. Pollard is one of the settlers who runs sheep. He yards them carefully at night. His block consists of a selection of 320 acres of second-class land, of sandy chocolate loam. In addition he has 209 acres of partly cleared country. Twenty acres of potatoes are usually cultivated. The varieties preferred are Coronation, Beauty of Hebron, and Vermont. The yields average 3 tons to the acre. Beyond the first

Mr. Stewart's homestead.

ploughing little other work is given, so that first-class results are not to be expected. The stock comprise 15 dairy cows and 16 head of store cattle, 5 working horses, and about a dozen others, including light horses and youngsters; 150 head of cross-bred sheep and 80 lambs are carried. Mr. Pollard finds that sheep brought in from the drier areas do not thrive here. The wool is liable to be wet for weeks at a time in the winter, and this adversely affects the constitution of any but local sheep. He has bred his flock up from local sheep, and they do fairly well. The average of wool last year was between seven and eight pounds, which brought 15d. per lb. It is on the coarse side. Lambing is late. The remaining stock comprise a couple of sows and a boar. These are fed on the small potatoes and sometimes on boiled rye, which does well in the district, being hardier than oats, which suffers in some years from the excessive wet.

The cows are mated to calve in July and August. They are then hand-fed till September, and then depend on the natural grass. They milk well right through the summer.

Mr. Pollard finds that at present, owing to the rabbits, it takes a couple of acres to maintain a sheep. He places reliance entirely upon natural grasses, though some rye grass about the homestead has done well.

Serious loss to implements, stock, and farm buildings from bush fires was sustained by Mr. Pollard recently.

Mr. T. Reynolds' Improved Methods.

This young settler has adopted a system of agriculture under which only concentrated produce leaves his farm. He abandoned the practice of growing potatoes for the market, and has centred his efforts on growing sufficient of this and other crops for feeding pigs and dairy cows. In this way the ruinous haulage charges and much loss of time were avoided.

Young cattle grazing on cocksfoot and clover, at Mr. T. Reynolds'.

In the management of his small dairy herd and of his pigs, Mr. Reynolds has adopted sound methods, and, while it cannot be claimed that his returns in these activities are at all extraordinary, they certainly do show a marked improvement over the yields per acre obtained from the average farm in the district.

It is a further tribute to the energy and persistency of Mr. Reynolds to know that when he started to actively work his partially improved block, in 1911, he had but a few pounds in his pocket, and was forced to buy all his stock-in-trade on credit.

The original purchases were:—

	£	s.	d.
Five cows, at £4 4s.	21	0	0
Grass seed	20	0	0
Separator	5	0	0
Plough	6	0	0
Babcock tester	1	10	0
Churn	0	15	0
Scales	0	10	0

In view of the stringency of the finances, many another might have been tempted to omit the grass seed, tester, and scales, but Mr. Reynolds, who had just returned to the settlement, inspired by what he had seen in the Taranaki district, New Zealand, regarded them as vital The results show that his judgment was correct.

The block, which is not being actively worked just at present, consists of 188 acres, of which 20 acres are sown to grass, and usually there are 12 acres of oats, 10 acres of peas, 5 acres of maize, 5 acres of potatoes, and 1 acre of field carrots. The rest is bush. The soil is a deep rich friable volcanic loam. The slopes are fairly steep.

On the 20 acres of grass six cows are maintained. The peas and potatoes are fed to four sows. Two working horses are kept.

One of the firm convictions that Mr. Reynolds brought back with him from New Zealand was the belief that artificial grasses and clovers would do well at Tolmie on the volcanic soil. The mixture sown was half a bushel of cocksfoot, half a bushel of perennial rye grass, two pounds of white Dutch clover, and three pounds of cow grass. The cow grass disappeared after a couple of years, but the others have done splendidly. The cocksfoot "holds" particularly well, and grows luxuriantly. The bulk of the feed produced on this paddock is remarkable, and a striking contrast to the native grass alongside it. Excellent crops of grass hay have been cut with a binder.

Mr. Reynolds while in New Zealand learned the simple art of using the Babcock tester, and determined to test his few cows systematically. Some of the cows were discovered to average only a 2.8 test, while others gave as high as 4.5 per cent. During 1915-19 two cows, which stood out from the rest, gave yields as follows:—

	Topsy.	Daisy
	lbs.	lbs.
September	—	750
October	930	828
November	1,110	1,050
December	1,170	1,050
January	1,023	930
February	840	728
March	775	713
April	600	465
May	372	310
June	300	150
July	155	—
Total	7,282	7,014
Test	4%	4%
Butter fat	291	280

The cows were hand-fed with oats and carrots during the winter. In summer the grazing was supplemented with maize. In the hot season of the year all cream was cooled to 55 degrees in a spring, and top prices were realized.

When in New Zealand Mr. Reynolds' attention was turned to pigs The results he got from the first sow which he purchased at Tolmie were encouraging. The progeny of this pig realized £135 in three seasons

The feed was pollard, potatoes and maize, and skim milk. Subsequently three pedigreed middle York sows were purchased from the Mansfield High School. They were mated with a pure Berkshire boar. The progeny of these three sows and another realized £125 in the first twelve months. A sty, with five fattening pens, capable of holding 30 pigs, was built of bush timber. The weaned pigs were allowed the run of the grass, and in addition received skim milk, pollard, and boiled potatoes. When broom corn seed in Whitfield was obtainable at below £5 a ton, supplies of this were purchased, and in a boiled state was found to be excellent feed. When the young pigs reached the vicinity of 55 pounds live weight, they were penned up and fed three times a day on a mixture similar to that just mentioned except that whole peas were added to this ration, and were fed dry. Mr. Reynolds claims to be able to put on 75 pounds weight on a pig in seven weeks in this manner. The Wangaratta market was topped on two occasions. In the winter time, when the carcass would keep well, the pigs were slaughtered and sold as pork. Last year from the four sows, pigs to the value of £150 were sold. The peas were on this occasion stacked, and the pigs permitted to feed on the stack.

Summing Up.

In these densely timbered areas of heavy rainfall, the necessity for maintaining the pastures in a productive state, and the high cost of haulage, definitely limit the types of agriculture that may be profitably practised. In addition, any method to be successful must recognise that many other local difficulties incidental to pioneering settlement exist. The small capital of the settler limits the erection of permanent improvements necessary to reduce labour and suppress vermin; but in spite of these difficulties, there are men who have successfully developed a system of agriculture suited to local needs. The sowing of grass and the use of the plough to produce fodder, and particularly concentrates, which can be turned into milk and meat, appears to be an essential. In view of the special difficulties, each area of grass, each head of cattle, and each acre of crop, must be made to yield a maximum by such methods as have been already outlined. A small area well looked after is often worth more than a neglected area ten times as large.

Besides being suitable for dairying and pig-raising, there is no doubt that the climatic conditions obtaining in these districts are specially well adapted to produce certain kinds of crops. They must be high-priced crops of small bulk. It is certain that this field has not been thoroughly explored. For instance, some of the high-priced agricultural seeds that are imported from the colder European countries should do well in these areas. Mustard is a case in point. The selectors at Beech Forest have already secured a reputation for seed potatoes, which command enhanced prices. In some districts possibly flax would do well. In addition to producing a fibre which when turned into tow is high-priced, the linseed obtained in the process is a highly useful concentrate, so valuable in these districts of rank plant growth for supplementing the feed of dairy cows. The growing of flax for fibre purposes would, however, have to be the result of a co-operative effort, such as is in vogue in parts of Gippsland. In the case of special crops, such as have been cited, unproved districts should be tested experimentally first. A trial plot of flax has been sown this year at Tolmie.

COPPER FUNGICIDES.

By F. de Castella, Government Viticulturist.

(Continued from page 112.)

Copper Acetates or "Verdets."*

After Bordeaux Mixtures and Copper Soda the best known and most widely-used Copper Fungicide is Acetate or more correctly, the Copper Acetates, for there are really several of these salts. They may, however, be considered under two headings—

1. Basic Copper Acetates—*Verdet-gris* or in English, verdegris of somewhat variable composition, as will be explained later, but consisting mainly of bi-basic copper acetate—$Cu(C_2H_3O_2)_2CuH_2O^2$.
2. Neutral Copper Acetate $-Cu(C_2H_3O_2)_2H_2O$.

Both constitute excellent fungicides, presenting similar advantages to "Bordeaux" and Copper Soda, in the way of immediate activity, and an adherent and durable reserve of copper; the deposit left on the tissues of the vine is sufficiently insoluble to afford lasting protection and yet soluble enough to constitute a powerful germicide. They present, in addition, the important practical advantages of not scorching the foliage, freedom from nozzle trouble and are very convenient as regards the making up of the spray mixture since they only require mixing with water, without addition of lime soda, &c., It is not too much to say that but for their rather higher cost the acetates would in all probability have superseded the other copper spray preparations.

Copper acetate is by no means a new fungicide. Verdegris, the basic form, appears to have been first proposed by M. Georges Bencker, of Montpellier, in 1886. The manufacture of this salt, as a by-product of wine making, constituted an important industry in the South of France many years ago. It is indeed curious that this same substance should now prove so valuable a specific for the treatment of vine diseases This use, in fact, seems likely to bring about a revival of the almost extinct verdegris industry which at one time supplied the needs of colour manufacturers, calico dyers, &c., in France and other countries.

The neutral acetate is of more recent introduction. Opinions differ somewhat as to the relative merits of the two, but both have been found to possess fungicide properties of a high order. It is somewhat strange that the eleventh report of the Woburn Experimental Fruit Farm (1910) which deals exhaustively with copper fungicides, should devote so little attention to copper acetates. Concerning the basic form, the only one mentioned, in addition to recording its occasional use it is merely stated that "the fungicidal properties of verdigris are not spoken of very highly." On the other hand in all French text books from Viala's *les Maladies de la Vigne* onwards, verdegris, and more recently, the neutral acetate, are considered to be equal if not superior to the other copper sprays.

Both acetates contain a higher percentage of metallic copper than bluestone or crystallized copper sulphate ($CuSO_4.5H_2O$) the copper content of which is 25 per cent. The neutral acetate contains 31 per cent., while verdegris contains from 33 to 35 per cent. of the metal.

* *Verdet* is a generic term given collectively, in France, to the copper acetates. The word is often used in the plural "*les verdets*" to include *verdet-gris* or verdegris and *verdet neutre*, the neutral or normal acetate.

Copper being the active fungicide agent, it follows that the acetates can afford equal protection in weaker spray mixtures than are needed if copper sulphate be employed. It is, indeed, generally admitted in France that a 1 per cent. *verdet* spray (1 lb. of verdigris or of neutral acetate to 10 gallons of water) is as effective as a 2 per cent. Bordeaux or copper soda (2 lbs. bluestone to 10 gallons water with the necessary lime or soda to neutralize).

As regards cost—Since the two acetates differ so little in copper content it may be assumed in practice that equal quantities of either are needed to make up the spray mixture—viz., 1 lb. to 10 gallons of water. In other words a 1 per cent. mixture as against 2 per cent. in the case of copper sulphate. The pre-war price of copper sulphate in France was £20 to £24 per ton as against £68 to £80 for verdigris; with the latter, however, allowance must be made for the fact that no lime or soda is required.

According to Beneker,* in pre-war times, the cost of the hectolitre (22 gallons) of 2 per cent. Bordeau or Copper Soda, including cost of lime or soda, was 10d. to 1s., as against 1s. 4d. to 1s. 7d. for a similar quantity of a 1 per cent. acetate mixture.

Notwithstanding this higher price many French vinegrowers treat their vines with *verdet* in preference to other copper sprays, considering that it affords equal if not more effectual protection and that the other advantages more than compensate for the extra cost.

Towards the close of the war the popularity of verdegris was strikingly illustrated. Wholesale requisitioning of French acetic acid for use in munition factories seriously hampered the manufacture of verdegris, the scarcity of which was so severely felt by vinegrowers that the *Confederation générale des vignerons*, at a meeting held at Montpellier on 6th August 1918, decided to petition the French Munitions Department to remove or modify the embargo on acetic acid. This was granted just before the armistice, the French Government consenting to supply *verdet* manufactures in order that this favourite fungicide might be made available to vinegrowers.

The importance of increasing the spreading or wetting power of spray mixtures by the addition of casein, soap and other substances has already been pointed out. Casein can only be used with an alkaline mixture; being curdled by acids it is unsuitable in the case of copper acetates, the reaction of which is slightly acid; it can, however, be replaced by gelatine at the rate of 1 oz. to 10 gallons of copper acetate spray mixture.

An important advantage of the acetates—both basic and neutral—is that they do not deteriorate after mixing. Bordeaux mixture, and more particularly copper soda, are of little value unless freshly prepared; with the acetates, on the other hand, no change takes place. Large vats of stock solution (or mixture) can therefore be made up, to be diluted to the 1 per cent. strength as may be required.

Verdegris, and more particularly the neutral acetate, leave less visible traces on the foliage than do Bordeaux or copper soda. This defect, though without importance as regards protection against fungus disease, complicates the supervision of the work; it is easily obviated by the addition of a small proportion of some light inert powder such as

* *Revue de Viticulture*, 7th November, 1918.

talc, kaolin or even plaster of Paris; ½ lb. of either of these substances to 10 gallons of spray mixture is usually considered sufficient. This addition is more useful in the case of the neutral acetate, the traces left by this salt on the foliage being almost invisible.

The relative merits and defects of basic and neutral acetate as well as a few practical points in connexion with their use in the vineyard must now be considered.

Basic Acetate—*verdet gris* or verdigris.*

This is the older form; it is sometimes known in France as *vert de Montpellier* (Montpellier green) since it was in the vineyards and cellars near that town that the verdegris industry formerly flourished.

The process of manufacture, though slow, is simple—so much so that it would be feasible for vinegrowers to manufacture their own verdegris and thus obtain it at a lower cost.

Sheets of copper† about 4 x 5½ inches and weighing about 8 to 10 ozs. alternating with layers of marc are built into a small stack 4 to 6 feet high. The alcohol of the marc becomes oxidised to acetic acid which attacks the copper to form acetate. After five or six days the stack usually presents a whitish, mouldy, appearance; the copper sheets are then removed. On examination numerous small crystals are visible which mainly consist of neutral acetate. The plates held in special racks or frames are next placed in a damp, close, room heated artifically to from 99 degrees to 104 degrees F. The racks, holding about 30 sheets each, are dipped rapidly in water every fourth or fifth day. After five or six such immersions the transformation into basic acetate or verdegris is complete; the coating of this substance, which is nearly ¼ inch thick, is removed by means of a knife and the copper sheets are again treated in a similar manner.

Two hundred and twenty lbs. of copper yield at each operation, the duration of which is about a month, 33 to 44 lbs. of verdegris. According to Camille Saintpierre 3 *muids* (650 gallons capacity) of marc yield 90 lbs. moist verdegris, which reduces to 59½ lbs. commercially dry, or 41 lbs. extra dry; 10 lbs. of copper are used up in the process.‡

Verdegris is very highly spoken of by Viala. Though only briefly mentioned in the first edition of *les Maladies de la Vigne* (1887) as a promising fungicide, in the third edition (1893) he says—

> The numerous tests of the last few years show clearly and indisputably that solutions of *verdet gris* constitute one of the most perfect treatments against mildew. The observations of many vinegrowers had previously indicated the remarkable adhesive qualities of *verdet gris*, qualities which have been scientifically proved by M. A. Girard . . . . . Scalding (of leaves) need never be feared . . . . The spray pumps never become clogged, and there is no need for agitators. On condition that the price of *verdet*

* Usually known in England as blue verdegris (it is blish-green in colour) to distinguish it from green verdegris, a form manufactured in England by treating copper plates with pyroligneous acid (acetic acid distilled from wood). According to Thorpe, blue verdegris consists mainly of the basic acetate—

$$(C_2H_3O_2)_2Cu_3O_2$$

whilst green verdegris has, as principal constituent, the sesqui-basic acetate—

$$CuO_2Cu_2(C_2H_3O_2)_2$$

† In order to insure even attack by the acid, these plates are freed from scale, if necessary, rubbed with a solution of verdegris and dried; unless this precaution be adopted, the first coating produced by the marc will be black instead of green! (*Thorpe.*)

‡ See Coste-Floret—*Les Résidus de la Vendange.*

should remain cheap we consider that solutions of this substance constitute one of the most perfect treatments against mildew.

Professor Ravaz also speaks favorably of verdigris, as will be seen by the following extract from *Le Mildiou, page* 129—

> *Verdet gris* is a complex substance, it contains mainly bi-basic copper acetate and some other acetates. Though its composition is not constant, basic acetate $Cu(C_2H_3O_2)_2.CuH_2O_2$ predominates. It occurs in small lumps or cones of a blue gray colour containing 33 to 35 per cent. of copper. In water it breaks up—
>
> 1. Into neutral acetate $Cu(C_2H_3O_2)_2H_2O$ which dissolves in the water.
> 2. Into hydrated copper oxide, according to M. G. Bencker, or into tri-basic acetate according to other chemists, sparingly soluble substances which are precipitated or crystallised. It is almost certain that some substances other than hydrated oxide are produced.
>
> At any rate this mixture supplies dissolved copper just as neutral acetate does, which acts immediately on the germs of the parasite, and slightly soluble precipitated copper, which constitutes the permanent reserve. *Verdet gris* should thus be very effective, and it has everywhere given good results."

The following extract* will give some further idea of what happens when verdegris is mixed with water—

> In water, the basic verdets do not give a true solution, such as neutral acetate does. Hydration phenomena occur; the viscous paste at first formed, if diluted slightly, becomes colloidal. If maceration is sufficiently prolonged and the quantity of water is sufficient, dissociation brings about the separation of a soluble part which colours the solution blue (neutral acetate) and light flakes which float in it, gradually falling to the bottom but which the slightest agitation again places in suspension. . . . .

It is this extreme lightness of the sediment which insures the great freedom from nozzle troubles characteristic of verdegris mixtures which may indeed almost be looked upon as semi-solutions; nevertheless, in order to obtain the best result, attention must be paid to one point—it is necessary to soak the verdegris in water for a few days before making up the spray mixture.

If verdegris has not been soaked long enough the resulting mixture will be lumpy, it will adhere badly and lose much of its efficacy.†

Directions for mixing.—Quantity required, 1 lb. for every 10 gallons of water. Soak the 1 lb. of verdegris in 1 gallon of water for 2 or 3 days with occasional stirring; before use, dilute to 10 gallons of water.

Should it be desired to increase the spreading power add 1 oz. of gelatine dissolved in a little water. The gelatine should be soaked in enough water to merely cover it, for a few hours, on adding about two or three times the bulk of boiling water it will immediately dissolve.

A stock mixture can with advantage be made at the rate of 10 lb verdegris to 10 gallons water, 1 gallon of which, taken after thorough stirring, would be sufficient to dilute to 10 gallons of spray mixture.

A stock solution of gelatine may likewise be made, at the rate of 4 ozs. per gallon—1 quart of this will suffice for 10 gallons of spray

* A. Dejeanne—"Les Verdets *Revue de Viticulture*, 30th June, 1910.
† Ravaz: *le Mildiou*, page 130.

mixture. Gelatine solution being very liable to putrefaction, it is well to add a small quantity of the verdegris stock mixture: say half a pint to 1 gallon.

Neutral or Normal Copper Acetate $Cu(C_2H_3O_2)_2 . H_2O$.

This crystalline salt is of more recent introduction for spraying purposes than verdegris; it is easily prepared from the latter by dissolving it in dilute acetic acid, evaporating and crystallising out, though there are other methods of preparation.

Being entirely soluble in water, the spray mixture can be prepared at once: as soon as dissolved it is ready for use, preliminary soaking for a couple of days, such as is required for verdegris, is no longer necessary. It is harmless to foliage at the spraying strength generally used, though it is probably rather more conducive to scalding than verdegris, especially in moist weather. Being applied in the shape of a clear solution, it ensures absolute freedom from clogging of nozzles.

It is soluble in thirteen parts of cold and five parts of hot water: the strongest solution would thus contain 7 per cent. of the salt. A stronger solution could be made with hot water, but part of the acetate would crystallise out on cooling.

In vine-growing practice, neutral acetate has latterly become very popular, as Chuard and Porchet pointed out:—*

> Of recent years there has been a tendency, in various vine-growing regions, to substitute a 1 per cent. solution of neutral copper acetate for the usual copper spray mixtures . . . . . Being readily soluble in water, and inoffensive for the vine foliage at the usual strengths of from $\frac{1}{2}$ to $1\frac{1}{2}$ per cent., neutral *verdet* is of very convenient application, and in the numerous field trials we have been able to check, it has proved itself at least as effective as lime or soda *bouillies* (copper mixtures).

Though completely soluble itself, the residue left by a spray application on the vine tissues soon undergoes change, passing from a soluble to an insoluble colloid (non-crystalline) form, practically identical with the residue left by a verdegris spray mixture; removal by rain, such as might logically be expected with an entirely soluble substance, need not therefore be feared—

> With neutral *verdet* it is an insoluble and colloid basic acetate which is spontaneously produced after spraying; whereas with dilute mixtures of basic *verdets* (*verdegris*), it is a mixture, difficult to define so far as proportions are concerned, of copper hydroxide, gelatinous basic acetate, and soluble neutral acetate; the latter ultimately giving rise to the insoluble basic salt (Bencker)†.

The time which must elapse before this transformation is complete, in other words, before the deposit loses solubility to a sufficient extent to afford lasting protection, and to resist washing off by rain, is a point of considerable importance, especially in a wet spring, and one concerning which the opinion of Chuard and Porchet may again be quoted‡—

> Owing to its ready solubility, the question arises whether rain water does not soon remove the residue left by a spraying with

* *Comptes-rendus de l'Académie des Sciences* (*Paris*) 1915.
† A. Dejeanne—Les Verdets, *Revue de Viticulture*, 30th June, 1910.
‡ *Comptes—Rendus* 1905.

neutral *verdet*, which constitutes a coating so slight as to be scarcely perceptible unless very closely examined . . . . . Our investigations reveal a fact of considerable importance, and one which, so far as we are aware, has not hitherto been mentioned in publications dealing with the treatment of mildew: viz., that by simple evaporation in air, of a dilute solution, sprayed on the leaves, the neutral *verdet* is transformed into basic *verdet* (verdegris), insoluble, or at least sparingly soluble in water, so that washing, even if very prolonged, does not remove it, but always leaves a certain proportion of copper on the sprayed tissues.

In support, numerous experiments are described in detail. In one series, three lots of vines (A B and C) were sprayed with $\frac{1}{2}$ per cent. neutral acetate. A was allowed to dry, whilst B and C were submitted to copious washings, corresponding to the action of heavy rain; respectively, twenty-four hours and six hours after spraying. Shoots from the different plots were then analysed, when it was found that if the proportion of copper present on the sheets from plot A be represented as 100 parts, those from plot B retained 81 parts, and those from plot C 61.5 parts of copper. In other words, even in the very unfavorable case corresponding to a heavy fall of rain soon after spraying, the copper removed was less than 40 per cent. of the total applied.

In further experiments, the washing of the sprayed leaves was purposely so much exaggerated as to lead to the anticipation that all copper would be removed: on analysis it was found that 12.5 per cent still remained.

Field experiments on a large scale were also conducted; numerous copper determinations, made towards vintage time, showed that of the total copper applied when spraying, the proportion still remaining was 4.5 to 19 per cent. in the case of Bordeaux mixture; 3.3 to 22 per cent for Copper Soda, and 8.8 to 31.9 per cent. with Neutral Acetate.

An interesting controversy ensued, Guillon and Gouirand criticising the conclusions of Chuard and Porchet. In reply the latter point out that concentration has a considerable bearing on the result; neutral acetate should be used in dilute solution. If concentration be excessive, it retards the decomposition into basic acetate and acetic acid—Guillon and Gouirand used a fairly strong acetate solution, viz., 2 per cent. Fineness of spray is also of importance; large drops hinder rapid evaporation, the resultant crystals not decomposing readily, are liable to removal by rain.

Vermorel and Dantony have contributed numerous articles to the French viticultural press concerning the value of acetates, and in particular of the neutral acetate. Vermorel's well-known *Bouillie éclair* (Lightning Spray Mixture) consists mainly of neutral acetate, one of the chief advantages claimed for it is instantaneous preparation, it being merely necessary to stir the powder into water in the proper proportions.

The following extracts from an article by Vermorel and Dantony may prove of interest.* After pointing out that soluble copper salts nearly always damage foliage to some extent, and that most copper salts present an acid reaction, they proceed to state—

If neutral *verdet* be used in rainy or very moist weather, there may be some slight leaf damage (scarcely ever of fruit) because the

* Les Verdets et le Tournesol (Copper Acetates and Litmus). Vermorel and Dantony. *Revue de Viticulture*, 23rd July, 1914.

solution dries slowly, and the salt, being soluble, acts corrosively, but neutral *verdet*, owing to loss of acetic acid, changes rapidly into basic *verdet*, which is insoluble, and therefore incapable of scalding. Now this transformation is very rapid if the spray dries quickly, it is less rapid if it dries slowly. Hence the practical conclusion that neutral *verdet* slightly burns the leaves only (the bunches are more resistant) if sprayed in moist weather.

In showery weather *verdets* should therefore prove inferior to other copper mixtures; as a matter of fact, precisely the reverse is the case. Leaves which have been spotted or slightly burnt by *verdet* sprays are nearly always those which are best protected from mildew.*

It would thus appear that the prolonged presence on the leaves of a concentrated copper solution can better render aseptic, than the necessarily extremely dilute solution resulting from even the most carefully prepared Bordeaux and Burgundy mixtures.

This is one of the reasons for the superior efficacy of *verdet* sprays.

It will be seen from the foregoing that the question is a more complex one than might at first sight appear. Both forms of acetate have much to recommend them; it would seem that if spraying be carried out in fine weather, with a probability of its continuance for a sufficient time to ensure the change to the basic form, that neutral acetate should give excellent results; if, on the other hand, rain is threatening, verdigris is to be preferred.

Ammona increases the adherence of neutral acetate; the proportion recommended is for each 1 lb. of acetate 1 lb. of liquid ammonia of 22° Beaume strength (s.g. ·924). In other words, in the case of a 1% spray, 1 lb. of liquid ammonia of above strength to 10 gallons of spray.

This addition of ammonia has not come into general use, except perhaps in showery weather the advantages gained seem scarcely sufficient to justify the extra expense.

Directions for use.—Dissolve 1 lb. of neutral copper acetate in 10 gallons of water; if in fine powder, this may be tipped into the water and stirred until completely dissolved. If in crystals, dissolve 1 lb. in 1 or 2 gallons of boiling water, and dilute to 10 gallons.

To increase spreading power, add 1 oz. of gelatine previously dissolved in a little water.

The addition of talc, kaolin or plaster of Paris at the rate of ½ lb. to 10 gallons of spray mixture will insure satisfactory marking of foliage for control purposes.

Stock solutions may be made by dissolving in hot water, or in cold water by suspending the crystals overnight, in a hession bag tied to a stick, so that the crystals are only just submerged.

The strongest stock solution which can be made is at the rate of 7 lbs. neutral acetate to 10 gallons water. For use, dilute 1½ gallons to 10 gallons, with water, adding gelatine and kaolin, &c., as above.

* This is quite in accord with the view held in some quarters, that for a spray to be really effective a small amount of foliage damage is a necessary evil!

FARM NOTES FOR JULY, 1919.

State Research Farm, Werribee.

H. C. Wilson, Manager.

During the month of July 134 points of rain have been recorded. Heavy frosts were a feature of the month. The weather generally has been cold and windy, and has been severe on stock in unsheltered paddocks. The plantations and wind-breaks planted six years ago are beginning to afford some shelter for stock during the winter months.

The season so far has been favorable for germination and growth of winter cereals. Lucerne fields, however, have not given the usual good winter picking for stock, no doubt due to the low temperatures and cutting winds experienced during the winter.

The warmer weather and steady light showers in the latter half of the month have given fresh life to stock. Crops, too, show signs of general advancement.

Cultural Operations.

The cultural operations for the month were as follows:—

Fallowing of 150 acres of land to depth of 4½ inches.
Rolling 500 acres of growing crops.
Ploughing 6 inches, and cultivation of 100 acres of field to be graded in preparation for lucerne seeding in September.
Excavation of main drain through proposed new lucerne land.
Subsoiling of 10-acre field to be devoted to irrigation investigation.
Renovation of old lucerne fields with heavy lime cultivation.
Completion of seeding of Oregon barley (100 acres).

Stock.

Horses.—Sixty working horses are being continually employed on seasonable farm operations. They are maintaining good hard-working condition when fed on shandy hay chaff (Warden wheat and Algerian oat mixture) damped with beet sugar molasses. Nineteen three-year old colts and fillies by the Clydesdale stallion, Major Oates, have been recently broken, and are now taking their share in the heavy work of the farm. Twenty-five farm mares are now showing in foal to the Clydesdale stallion, Baron Wighton. Small quantities of lucerne chaff, from 6 to 10 lbs. as a supplement to shandy chaff, has proved to be both palatable and fattening to the horses, and this mixture gives better results than either lucerne chaff or shandy chaff separately.

Cattle.—The Red Polled herd, now 110 strong, are both maintaining good condition and milking well. Ample supplies of winter fodder are on hand. Chaffed lucerne and barley silage has been a boon to the dairy herd during the cold winter months. The brick silos and fodder bins adjacent to the milking sheds have saved much labour in handling. Feeding is simplified when the herd is fed during milking time in the byres. During the month eight calves were dropped, and six aged fat cows were sold to the butcher.

The Holstein Fresian Herd, twenty in all, recently transferred from Wyuna State Farm are doing well, and improving appreciably in milk yields. Although these cattle have up to the present been somewhat restless in comparison with the Red Polls, no doubt they will become more docile when they get more accustomed to their new conditions.

Sheep.—July is a particularly severe month on the plains for the flock owner. Provision must be made for special fodder crops and shelter provided wherever possible if the condition of the stock is to be maintained. Failing this, light stocking must necessarily be resorted to. The provision of winter fodders is especially necessary where stud flocks are kept or fat lambs are being raised for the early markets.

The total area of the farm is 2112 acres, 950 acres of which are under wheat, oat, barley, and experimental plots, 150 acres fallowed this month. We have been able to maintain through the winter in first class condition 1,220 grown sheep (200 of which are stud—Border

Brood Mares with Foals at foot.

Leicester and Suffolk flocks), and raise 900 lambs for the fat markets besides maintaining 100 head of cattle and 70 horses on farm-grown fodder. This has been done—

(*a*) By the aid of irrigated lucerne and sown grass fields, 235 acres in extent.

(*b*) The use of the self-sown growth on last year's cropping fields, 1,000 acres, 250 acres of which are now either fallowed or under crop.

(*c*) By the feeding off of a 60-acre field of rape sown on land to carry wheat next season.

(*d*) And finally by the judicious grazing of our early-sown hay crops, and the use of 150 acres of natural grass country, swampy in nature, which cannot at present be cultivated.

Particularly during these cold winter months is it true that one mouthful of the fodder or grass grown on these cultivated areas is worth two of that natural pasture on uncultivated paddocks.

Early Fat Lambs.

Following the lessons learnt from our recent fat lamb raising experiments, we have raised 600 Suffolk cross-lambs. These lambs were dropped during the months of April and early May to Lincoln Cross-Merino ewes, and are now from twelve to fourteen weeks old. Twenty young vigorous Suffolk rams were joined on the 20th of November last with 800 six-tooth cross-bred ewes, the ewes being shorn early; were flushed with good feed only in November, and took the rams almost immediately they were joined. Six weeks later these Suffolk rams were drawn, and to secure a high percentage a second mating was done, this time to Border Leicester rams in February.

The results show 596 Suffolk cross dropped in April and May, and 163 Border Leicester cross lambs now ready to be marked. Last season the Suffolk cross lambs realized at Newmarket sales from 24s. 8d. to 29s. 6d., at from fifteen to seventeen weeks old. The first truck will be ready for market about the middle of August. There is always a ready demand for good quality fat lambs at this time of the year.

Suffolk Ewes and Lambs.

Feeding off of Early Sown Crops.

This practice, although not generally followed in the district, may be successfully and profitably done when the crops—wheat or oats—are sown early, and receive normal autumn rains. Oats or wheat, or a mixture of the two, sown in late March or early April on fallowed ground can nearly always be fed off to advantage in June and July when the flocks (particularly ewes and lambs) need a little extra stimulating food.

This month a 60-acre field of shandy hay sown during the first week in April on fallowed land was stocked with 600 ewes and 596 twelve to fourteen weeks old lambs for seven days. The crop has again recovered and looks well. Careful feeding of this kind when the weather is fine and the land firm has proved to be of great benefit to heavy early crops, and the value of the food to the stock can be placed at a high figure, particularly so when the flock owner is raising fat lambs for the early markets.

Rape Sown on Early Fallow.

The advantage of early fallowing is now generally admitted on the clay soils of this district. Besides improving the fertility of the soil and aiding in the destruction of weeds such as wild oats, it offers opportunities for the sowing of catch crops for winter and early spring feeding.

A field of 60 acres which was foul with wild oats following a crop of Carrawa wheat last season was ploughed to a depth of 4½ inches in April this year, and seeded with 4 lbs. of Dwarf Essex rape, and 30 lbs. of super per acre. The seeding operations consisted of drilling immediately after the plough without any extra cultivation except the cover line attachment to the drill. This system of catch crop seeding cost, approximately, 6s. 6d. per acre above fallowing cost, and if the season is a favorable one good winter and spring picking for stock is available. Already the first grazing of this field resulted in carrying 600 ewes and 596 twelve to fourteen weeks old lambs for a period of six days. Further grazing will be available in August, September, and October, after which the field will be disc cultivated before harvest. Fallows seeded to rape in this way during July and early August last season were fed off during October and November. The land was then worked up with a disc cultivator, and now carries a good crop of wheat and oats for hay. Sown in May of this year.

Systematic sowing of rape on early fallows in this district undoubtedly shows a profit in average seasons when fed to sheep, and if the subsequent cultivation is carried out, the crop which follows will be benefited by the practice.

Rape sown as the main crop for fodder would give greater yields than the system above explained, but the uncertainty of the result in the district, after the necessarily high cost of production, forces this catch crop system into practice.

Farm Tractor and Horse-drawn Implements Trials.

These trials are to be held on a field near the Geelong railway line this season during the week ending 20th September, under the auspices of the Royal Agricultural Society of Victoria.

Full particulars of interest to farmers who intend to visit the farm during the tractor trial week may be obtained from the secretary of the society.

Last year very interesting comparisons were drawn from these trials This season they will cover a greater range of cultural activities, as many horse-drawn implements are to be included.

Farmers that take this opportunity of seeing these tractors and implements at work should be able to judge for themselves the merits of the work done.

Returned Soldier Trainees.

Early in October of 1917 quarters to accommodate twenty returned soldiers were completed. Systematic practical training of these men has been undertaken by the farm staff since that date. The duration of the course has been fixed at six months, but if a trainee proves to be apt at his work he may be given a qualifying certificate before the expiration of this term.

Trainees are catered for at their quarters, and their duties during training are so arranged that they receive a routine of general farming which should aid them if allotted land when they complete their training.

Besides the practical course evening lectures are given by officers of the Department and farm staff on agricultural, live stock, and dairying problems.

Very keen interest in the work has been taken by most of the returned men, and it is particularly gratifying to see the rapid progress of some who have had no previous experience in farm pursuits.

During the month nine trainees were given their clearance certificates, and ten new men were taken into residence. There are at present eighteen undergoing training.

Poultry.

During the past month progress has been made with the work of erecting the poultry houses and yards for the poultry recently transferred from Wyuna State farm.

Six incubators are now being actively employed for the first time this season, and the necessary brooder equipment will be completed during the coming week.

The poultry are being temporarily housed in a large straw shed built three years ago as a stock shelter. This cover has proved to be of great benefit to the fowls during the cold winter months, while the permanent buildings are being completed.

The breeding flock consists of over 600 birds of three breeds—White Leghorns, Rhode Island Reds, and Black Orphingtons.

The main feed used has been dry mash and wheat, with liberal supplies of green lucerne.

Notes on Experimental Plots at Werribee for July.

G. S. Gordon, Field Officer, Research Farm, Werribee.

Seasonal Conditions.

Bitterly cold weather, accompanied by frequent light showers, occurred during the early part of the month. The rainfall has been sufficient for the time, but there is little moisture reserved in the subsoil and to insure full crops a good soaking fall is required before spring.

Seeding.

All the experimental plots, excepting a few late seeding tests with flax, have been sown. Selected sugar beets of high sugar content and prolific strains are being transplanted for seed production in the seed improvement plots.

Crops.

The benefits of early sowing are once again indicated by the advanced condition and vigour of the early sown crops. Some of the bulk hay crops have already provided splendid sheep feed while the late sown crops are not only backward but making comparatively little growth In the green manurial rotation field, Yandilla King wheat is making very poor winter growth. This is usual at Werribee with this variety, but it picks up in the spring, and is a reliable yielder at harvest time

The green crops of barley and oats are growing strong, but the rape seems to have come to a standstill with some of its leaves turning to a purple colour. The plots to be fed off this year were, therefore, stocked with sheep on 26th July. Small insects—resembling red spiders—known as pea mites have done considerable damage to the rape on the experimental plots this year. In the manurial field the plots which were given a dressing of farm-yard manure, and those which received superphosphate look the best at present. Similar results are apparent on the plots which were sown with a combination crops of oats and peas without manure to test the residual effect of the fertilizers used in previous years.

Summer Forages.

Ten acres have been ploughed preparatory to working to a fine tilth and seeding to experimental summer forage crops. The value of ample reserves of fodder is fully recognised at Werribee and at the present juncture the growth and conservation of fodder crops is well worth the serious consideration of all stock owners. The absence of good winter rains over a considerable area of the stable and the possibility of a short dry spring brings into prominence the question of providing sufficient feed to carry the increased number of stock through the coming summer. Lucerne has undoubtedly maintained its reputation as "King of Summer Fodder Crops" at Werribee. Maize is also a good summer crop under irrigation. The following list affords a comparison of the average yield of some of the best of the other irrigated forages grown during the past two years:—

Crop.	Average yield per acre.		Remarks.
	tons	cwt.	
1. Imphee or Planter's Friend ..	14	0	Weights recorded late in the autumn, and to some extent indicate the varieties which have kept green and succulent the longest.
2. Early Orange Cane	11	18	
3. Early Amber Cane	10	0	
4. Sorghum Saccharatum	7	16	
5. Yellow Branching Milo Maize ..	7	12	
6. Sudan Grass	1	10	
7. Japanese Millet	7	0	
8. Pearl or Egyptian Millet	5	5	

Imphee or Planter's Friend is generally a heavy yielder, has a softer stem than Sorghum or Amber Cane, and not only withstands dry conditions well but being somewhat resistant to cold and early frosts it carries well into the autumn and early winter.

Early Orange Cane is somewhat similar to Amber Cane, but has given a better yield. Sudan Grass resembles a miniature Sorghum, and has fine stems. Though it looked well it did not weigh up as well as the other forages. All the sorghums require to be left till well in flower or else cut a day or so before being fed to stock. Japanese Millet, however, can be fed off at any time without danger, and is probably the most suitable millet for this purpose.

EXPERIMENT FARM, RUTHERGLEN, JUNE AND JULY.

The farm manager, Mr. P. B. O'Keefe, in his reports covering the operations of the farm for June and July, states that the continued shortage of the normal winter rains is causing owners of stock in the district to look forward somewhat anxiously for a good downpour to insure an early growth of spring grass, and to fill dams for use during the summer.

During June half the normal rainfall was recorded, viz., 150 points In July only 66 points fell. There has been no "run off" into the dams at the farm since last spring. The rain has, however, been sufficient for the needs of the cereal crops, which look well, except those sown after the end of May. April-sown crops are very forward, and have been fully utilized in supplementing the grazing available for sheep on the grass and stubbles. The oat crops have been heavily fed off with sheep, and most of the wheat crops have furnished light grazing.

The paddock sown with a mixture of Dun peas and oats for silage is making steady growth. The farm manager finds that when sown early for a silage crop this variety of pea is not so suitable as Partridge, as it is too forward before the winter sets in. For all other purposes the Dun pea is preferred

Cultural Operations.

The drilling of 40 acres to barley in early June concluded the sowing of cereals on the farm, and brought the total area under crop to 520 acres. During July, however, a further 100 acres have been ploughed, and is being seeded with Dwarf Essex rape at the rate of 4 lbs. to the acre with 90 lbs. of superphosphate. The paddock was worked down to a fine tilth and rolled with a heavy plain iron roller before and after the drill. The seed was sown as shallowly as possible and through the manure run of the drill.

It is found sound practice to refrain from mixing the seed with the manure until the day of sowing, because of the danger of injuring the germinating powers of the rape. The thorough consolidation of the seed bed of land freshly ploughed and sown to small seeds such as rape is regarded as important. After the final rolling a light lever harrow with teeth set backwards was put over the field to leave the surface mulched

At Rutherglen the spring-sown rape is found to do far better than that sown in autumn.

A paddock of 13 acres at the Black Dog Creek has been subsoiled for lucerne to a depth of 14 inches. Two teams were used. The first of two horses, with a single furrow plough, turned over the soil to 8 inches. The second team of four horses followed immediately behind with a single-furrow plough from which the mouldboard had been detached. The shear used was one from which the wing had been broken off. During July a number of ornamental and shelter trees have been planted

Stock.

Twenty draught horses are kept in regular work, the balance are out to grass. Those at work have been half clipped

During the month five fresh cows have come in to milk. In addition to pasture the dairy herd receives a liberal ration of silage with bran night and morning. Owing to shortage of grass young steers and heifers are receiving silage as well. They appeared to suffer from digestive troubles until a small quantity of bran was added to the ration.

The services of the stud Ayrshire bull are being availed of by a number of local farmers.

All sheep are in excellent condition, and the cross breeds are lambing freely. Up to the present 86 per cent. have been marked, but 90 per cent. is expected. The ewes were mated with two-tooth Border Leicester rams. The drop was more even than in past years, and the losses have been small, though crows have been troublesome.

The following sales have been made during June and July. One hundred of last year's late lambs which were carried over realized an average price of 25s. 6d. on 12th June. A second batch of 70, sold a month later, owing to the slump in the market, realized 24s. 1d.

The pigs on hand comprise—Six sows and 17 boar, 17 forward stores, and 27 suckers—51 in all. The feed at present consists of a mixture of crushed seconds wheat and crushed barley. Skim milk is added to the midday meal. Young pigs get a small quantity of pollard with skim milk. During the mouth 28 pigs were sold, viz., 18 baconers, at £3 17s. 6d.; 2 bulk fatters, at £7 6s.; 8 slow-growing stores

Experimental Plots.

The officer in charge, Mr. T. M. Whelan, reports that the seeding of all but the late sown experiments was completed before the 1st of June. The field looks exceptionally well. Fallowing operations and the feeding off to sheep of forage crops sown in rotation with wheat is now in progress. Barley provided the heaviest bulk of feed of all the forages sown this year.

The plot of Sunset wheat is fully 15 inches high, and is growing much more rapidly than such standard early variety as King's Early and Gluyas.

The early-sown flax plots look well, but those sown in June have not done nearly so well.

The 20-acre field set aside for pasture top-dressing experiments has been manured

INTERNATIONAL GENERAL CROP.

The International Institute of Agriculture has issued a report of the area under wheat, rye, barley, oats, and other crops in the principal countries of the world. It is stated that the area under wheat in the Unted States has been increased 16 per cent. as compared with that of last year, while for every country except the United States there appears to be a decided decrease in the wheat areas amounting to a very large decline in the case of British India.

As regards the crop condition on 1st April, it is reported as a good one for wheat in the United States and for oats in Ireland. It is classed as satisfactory for wheat in England and Wales. In Italy, as well as for crops in general, the condition was an average one of the date named, while in Scotland the wheat was reported as below average in condition

II.—TOMATO DISEASES.

Leaf Spot of Tomato (*Septoria lycopersici* Speg.)

C. C. Brittlebank, Vegetable Pathologist.

The fungus causing the "leaf spot" disease of the tomato was first described by Spegazzini, in Fung. Argt., Pug. IV., No. 289, 1882. It would seem from records relating to the disease that it was present in many places, but had not been brought under the notice of plant pathologists.

Specimens in our herbarium (Exsicc. No. 93), Briosi and Cavara, 1889, still show the leaf spots, pycnidia, and spores.

Brief mention of the disease is made by Professor A. D. Selby, Ohio, Bulletin No. 73, 1896, under the heading "Tomato Leaf Blight: A New Arrival in the State of Ohio." Prior to Selby's paper, the loss caused by the disease in some of the States was considerable.

In Australia the disease was first recorded by Dr. N. A. Cobb (*Agricultural Gazette*, New South Wales, Vol. XIII., page 410, 1902.) Dr. Cobb mentions that the disease was present during the summer of 1901, and also to the apparent rapidity of dissemination. The second Australian record was by Mr. McAlpine, in the *Journal of the Department of Agriculture of Victoria*, Vol. II., page 70, 1903. Mr. McAlpine says:—"Though this particular disease has not come under my notice in Victoria, very probably it has existed here in a mild form for some time past." Our records show that the disease has affected tomatoes in all parts of Victoria, and this would bear out Mr. McAlpine's statement that the leaf spot disease was probably in Victoria for some time prior to 1903.

Symptoms of the Disease.

On Leaves.—The first indication of attack to be noticed is an unthrifty appearance of the plant. If the lower leaves be carefully examined numerous minute water-soaked spots may be observed. These spots are at first inconspicuous, and no definite discoloration is apparent in this early stage of attack. Later the spots enlarge and assume a more or less circular outline, and become darker than the normal leaf tissue. As the disease progresses the affected leaves assume a dark-brown, or greyish-brown colour, harden, and in hot dry weather become brittle.

In some cases the number of leaf spots may be few and small, and in others the points of infection may be so numerous and close together that the whole leaf is involved, turns brown, shrivels, and in time breaks up.

When the infection is light, there may be from three to six spots on the leaf. If these spots be closely examined minute black dots are seen in, or towards the centres of the affected area. These are the spore cases, or pycnidia, which contain the spores, and vary in number from three to ten or more.

When the whole leaf is involved, withering and death take place rapidly, and the spore cases are not formed till autumn or early in the following spring, when they develop in great numbers, especially if the vines be piled in heaps and the leaves kept moist.

In a general attack all the lower leaves are affected; they turn yellow, become spotted, wither and die. The disease works upwards, affecting the entire foliage with the exception of that at the tips of the stems, leaving the fruit and stem bare.

On plants which have reached this stage the fruit, usually small and watery, is exposed to the direct rays of the sun, and is destroyed by sun scald.

How the Disease is Spread.

Seedlings are liable to be attacked while still in the frame, and plants which have borne a full crop are not immune. As a rule, however, they shew the effects of the disease at or about the time they have set the first hand of fruit.

Seed bed infection is far more common than growers suppose, and many thousands of seedling plants affected with the disease are sold annually. It is, therefore, unfortunate that the custom of using the same soil and frames year after year without the slightest effort to sterilize either, is so common. A fertile source of infection is found in the old trash from a diseased crop, which is, as a rule, either ploughed in or thrown upon the rubbish heap, or even sometimes mixed with the soil in the cool frames.

So long as these slip-shod methods are continued we must expect the disease to claim a large number of plants each season. Even when diseased seedlings are transplanted vigorous growth may hold the disease in check until the plant feels the extra strain consequent on a supply of food being diverted to the developing fruit. It is at this period of growth that the grower as a rule observes the evidence of disease.

On badly affected leaves the spores are, in the presence of moisture, exuded in sticky masses, and on drying are held firmly to the leaf surface, and may be removed only with difficulty. In rainy weather they float about the leaf surface, and numbers are carried to neighbouring plants by rain drops and splashes, but by far the greater number reach the soil by drops falling from the leaf tips. It has been observed that when there are a few diseased plants in a plot, the disease spreads rapidly in the direction of the prevailing winds.

When we consider that the spores adhere firmly when dry, either in the spore case or on the leaf surface, it is difficult to account for the spread of the disease over large areas in the absence of rain. It can, however, be accounted for by the dust from the soil on which the spores have been carried, by the drippings from diseased plants being blown or carried by air currents to the lower leaves of the plants. An analogous case is found in the "black spot" of the vine—*Manginia ampelina*, Vil. et Pt. The spores of this disease are without doubt carried by the spore-laden dust from the soil beneath the diseased vines.

A number of tomato plants were sprayed with water containing spores of *Septoria lycopersici* (Speg.), and all developed the disease, and produced spores within twelve to fourteen days. On the other hand the check plants were clean.

Control Measures

The chief causes of infection have been noted viz., the old diseased plants from last year's crop, soil containing fragments of diseased plants, and hot-beds and cool frames.

If possible the soil used for seed-beds shou'd be sterilized. If means for sterilization are not procurable fresh soil should be obtained.

Old plants must never be placed on the manure heap or ploughed in, but should be carefully gathered and destroyed by fire. The seedling plants should be sprayed as soon as they are strong enough to stand the spray, *i.e.*, when about two and a half or three inches high A suitable spray can be made up of 2 lbs. bluestone, 3 lbs. of lime, and 50 gallons of water. A spraying with the same mixture just before transplanting is also necessary. When in the paddocks, and the plants have become established, a spray, composed of 6 lbs. bluestone, 4 lbs of lime, and 40 ga'lons of water, should be applied.

Care must be taken during spraying operations to direct the spray so that the lower surfaces of the leaves will be covered. This is most important, as the major portion of infection takes place on the lower surface. In districts where the plants are staked, the application of the spray will give better results than when applied to plants in bush form.

The crop should on no account be worked when wet by rain or dew By so doing the spores will be carried by the hands, clothes, and tools of the worker from diseased to healthy plants.

THE MINERAL REQUIREMENTS OF THE DAIRY COW.

By E. W. Murphy, Dairy Superrisor.

Among domestic animals, the dairy cow is the most economical producer of human food. According to Jordan, the growth of a pound of edible beef solids requires a food expenditure nearly seven times as great as is necessary for the production of a pound of milk solids. The milking cow, therefore, is to be regarded as a very efficient machine, and a complete knowledge of her body's working is very desirable, so that we may be able to adjust any disturbances occurring in the functioning of the parts

Owing to deficiencies of the soils of many areas in Victoria—deficiencies aggravated by the extensive system of stock farming causing a depletion of the surface soils—the pasture is unsatisfactory, and the dearth of essential mineral elements becomes a limiting factor in the productive capacity of the milking cow.

Dr. E. B. Forbes, Chief of the Department of Nutrition at the Ohio Experiment Station, has been carrying out a series of most elaborate and exhaustive experiments regarding the income and outgo of mineral elements of the dairy cow fed on ordinary rations, and his findings are in accordance with our practical experience here. He states that almost nothing has been written on the subject, and it is ordinarily assumed that animals fed chiefly on grass and hay receive and digest as much mineral nutrients as is required by their maximum functional activities. The prevalence of this belief among practical and scientific students of animal production seems scarcely to have been affected by the existence of very many reports of malnutrition of just such animals.

Science Bulletin No. 12, Department of Agriculture, New South Wales, 1914, states that on those areas where malnutrition disorders are prevalent the grasses contain a remarkably low amount of minerals.

It may be said that a good milch cow raises an overdraft on her system, and during the dry periods the amount has to be made up. Consequently she needs the best attention all the time, and, therefore, it is not good business to turn her into any rough, back paddock until she calves again.

About Hamilton, on paddocks where the grass seems satisfactory and is abundant, and on which adult store cattle will thrive, milking cows will die unless provided with salt and bone-meal. Henry estimates that an ox stores 0.22 lb. of ash in a week, and that the dairy cow secretes in her milk 1.35lb., or about six times as much. Thus an ox will fatten where a milking cow will die.

A really good text-book, *Dairy Cattle Feeding and Management,* by C. W. Larson, M.S.A., Ph.D., and F. S. Putney, M.S., of Columbia and Pennsylvania Colleges respectively, has recently been published. It gives the summary of the functions of the ash as follows:—

1. Constructive purposes.
2. Carriers of gaseous products.
3. Maintenance of neutrality or of necessary acidity or alkalinity
4. Control of muscles.
5. Movement of liquids.
6. Stimulation of vital reactions.
7. Assistance in coagulation of the blood.
8. Solution of proteids.
9. Digestion of proteids and fat.

Salt is an article of very great importance. It provides the chlorine for the gastric juice, and the alkali (sodium) for the blood. Forbes says that the efficiency of the blood to carry carbon dioxide from the tissues to the lungs, where it may be cast out, depends upon the presence of sodium, which acts as a vehicle for carrying waste matter to the lungs. If there is a failure of the blood to do this, then death must ensue, and where partial elimination occurs, vitality is lowered and resistance to disease organisms is lessened.

Sir Arnold Theiler, of the Union of South Africa, states, in his Annual Report for 1916, that he still believes, notwithstanding the contrary opinions expressed, that the form of paralysis known as lamziekte which affects cattle is due to the accumulation of grass toxins in the system, and he emphasizes the need for promoting oxidation.

Dairy farmers should bear in mind that cows require from 1 to 2 ozs. of salt per day, according to their yield of milk. In addition, they should occasionally be given amounts of calcium, magnesium, and phosphorus, even when dry. It pays, therefore, to top-dress the pastures in many parts of Victoria. South of the Dividing Range most of the land needs liming, and soils in almost every part of the State respond to phosphatic dressings.

SHEEP CLASSING.

By the term sheep classing is meant the grading or classing of the flock by a competent classer in order to eliminate or cull the undesirable units of the flock which retard its improvement. We must remember that sheep breeding is a constant tug-of-war with nature, and, if nature is allowed to have her way unrestrained, the sheep will very soon deteriorate, and in time only carry sufficient wool to protect itself against the weather.

The science of breeding teaches us that "like begets like," and it does not matter how good the rams are that are used; if the bad, faulty ewes are left in the flock, as sure as night follows day bad lambs will be born. Some farmers contend that it is unnecessary to cull the faulty ewes, and maintain that superior rams will effect the desired improvement. These men do not understand breeding, and only credit the rams with prepotence, whereas they forget that if bad ewes have been bred on faulty lines long enough, they will be as prepotent as the rams, if not more so, and, consequently, faulty progeny will result, and the desired progress be retarded.

The Value of Sheep Classing.

There is no surer, sounder, and less expensive method of improving the flock or flocks of a country than by thorough systematic sheep classing. The magnificent improvement that has taken place in the flocks of Australia during the last thirty or forty years, and the unrivalled position she holds as the premier sheep and wool producing country of the world, have been achieved by sheep classing.

Many breeders labour under the delusion that once they have acquired a flock of high excellence their labours ar over, and all they have to do is to wait for the profits which will accrue. They are wrong. Their labour has just begun. There is no standing still in sheep breeding. There must be either a forward movement or else retrogression, and if the farmer sits still the tendency will be to retrograde.

There must be no sentiment in sheep breeding. If we expect a sheep to be prepotent with regard to its good points, surely it is only reasonable to expect the same regarding the bad points, and perhaps more so because nature is usually assisting.

Frame and constitution should be uppermost in the classer's mind, for without these two essentials the flock will be like a house built upon sand.

The Best Time for Classing

is when the sheep have from ten to twelve months' growth of wool on. I would not recommend the classing of sheep with less than eight months' growth. The classer may risk it if he is exceptionally well acquainted with the flock. On account of lambs altering so much, it is a very risky undertaking to class them with their lamb jackets on. Lambs should be shorn at from three to six months old. They should then be classed as two-tooth sheep, and again as four-tooth before they go to the ram. I may here mention that, in order to keep up the frame and constitution

of a flock, two-tooth ewes should not be allowed to breed unless they are exceptionally well grown. They should be put to the ram at from twenty months to two years old. If this course is adopted they usually grow into bigger sheep, last much longer, and prove better breeders and mothers than if allowed to breed too young.

When classing the *ordinary* flocks, classers would do well not to pay too much attention to the fine or fancy points. For instance, if an otherwise good flock ewe has a smallish eye, a covered-up face, a black spot on her ear, or a streak in the hoof, she should not be culled. In a flock where the standard is set very high, more attention could be paid to the finer points. In a stud flock we must try to get as near perfection as possible. Uniformity with regard to frame and wool should be the object of the classer.

The percentage of culls to be taken out will be determined by the classer, and will greatly depend upon the standard of excellence set in the flock. In some flocks the number of culls will be decided by the number of sheep the farmer can afford to dispose of: I personally very rarely take out less than 25 per cent., and more often 25 to 33 per cent. The heavier you can afford to cull the more rapid will be the improvement of the flock.

It is a good plan when you have finished classing to go through the sheep in the yards and pick out any faulty ones with regard to frame you may have missed.

The Ideal Merino.

The classer should endeavour to keep the following ideal in his mind's eye when classing:—

The Merino ram should be a well-built, symmetrical sheep, standing on four good, strong, straight legs, wide across the shoulder and loins, with a deep chest, straight back, and well-sprung ribs. He should have good thighs, be well let down, and roomy, with a good underline. He should have a strong, well-shaped masculine head, with good, thick, well-curved horns of a good colour, showing distinct corrugation; a kind, soft, open face, with a kind eye, a broad, thick muzzle, with a good, sound mouth, and soft, downy ears. The head must be set on to the body with a rather short, thick ram's neck.

He should have a full, bold, even front, with a good tail, and should move with a free, bold, masculine carriage.

He should be well and evenly covered with a strong, bright, masculine fleece, with plenty of "guts" in it, of good length, full of character and quality, with a good tip.

These remarks are applicable to ewes as well, with a few exceptions, of course.

Systems of Classing.

There are two systems of classing which may be adopted. The first is making three lots, No. 1 flock, No. 2 flock, and culls. The No. 1 flock should consist of all the square-framed sheep carrying the best wool. The No. 2 flock should also have good frames, but the wool would not be so high class. Good, suitable rams should be mated to both No. 1 and No. 2 flocks. The object of the farmer should be gradually to increase the No. 1 flock and decrease the No. 2.

The second system is to class into two lots, the ordinary flock and culls. For all practical purposes the average sheep farmer, not having his farm cut up into several paddocks, will find the second system a very simple and effective method of improving his sheep. If the culls are taken out each year and good commercial rams of the same breed or type as his flock are used, the farmer will very soon find himself the owner of a uniform commercial flock, which is the pride of every good flockmaster.

The culls should never be bred from, but they should be fattened and sold to the butcher. Farmers who have the welfare of the sheep industry at heart should never sell the rank culls to a brother farmer. The culls from high-class flocks should be gone through a second time, and the worst of them should be taken out and sold to the butcher, or be killed on the place for rations. The balance could be sold to some farmer not so far advanced in sheep breeding.

Sheep that should be Culled.

Sheep of the following description should be culled: Small, undersized, weak-constitutioned, and unthrifty sheep, excessively cow-hocked or turkey-legged sheep, slab-sided, ewe-necked, hollow backed, goose-rumped, narrow-chested, tucked-up, devils-gripped sheep, excessively wrinkled sheep, bad mothers, sheep with kempy faces, sheep with under-shot or over-shot jaws, sheep with black blotches inside the mouth or on the tongue, and rams with black streaks in the horn or black hoofs.

Sheep having the following wool defects should also be culled: Any sheep whose wool is less than 1½ inches long at 12 months' growth; sheep showing kemp through the wool; short-stapled, hard-woolled, and excessively yolky sheep having a yellow, sticky yolk; sheep that strip their belly wool and points; sheep with black or coloured spots in the wool or on the legs; sheep whose wool is thin, feathery, and light; sheep showing excessive ropiness or lockiness; sheep with bad, watery bellies, and showing a tendency to wateriness in the fleece; sheep having coarse britches, and those showing coarse hair in the fleece; sheep with loose, open backs; and sheep having straight, wiry, cross-fibred wool. (*N.B.*—Small, well-defined black spots on the nose or on the ears are not of much consequence.)

Regarding bad mothers, I am often asked which sheep have the most milk. Obviously, the best-constituted, roomy, large-framed, well-let-down ewes are usually the best mothers. Now, in order to get good mothers with plenty of milk, attention must be paid to the ewes at lambing time. If there is an abundance of feed and a ewe with her second or third lamb refuses to mother her offspring or has no milk, she should be culled without hesitation. Young ewes with their first lambs could be given another chance. The ewe that refuses to mother or cannot rear a lamb in a good season is of no more use to a farmer than a wether, and only by rigorously culling such undesirables can a farmer expect to build up a flock of good mothers with plenty of milk.

Study the Ram.

After the ewes have been classed the rams to be mated to them must be carefully examined. They should always be better than the ewes, and should be particularly strong where the bulk of the flock is lacking

in order to counteract the deficiency. Do not breed for frame alone or for wool alone. Try and strike the happy medium. Do not sacrifice the one for the other, but endeavour to produce a strong, well-built, healthy sheep which is able to carry comfortably the commercial fleece you wish to produce and yield a remarkable carcass of fair weight for the butcher.

The rams should be purchased from some reputable breeder, and a fair price paid for them. It is false economy to purchase inferior rams at any price. Buying rams is clearly a reproductive investment. The more you pay for them the better they will, or at least should, be, and the sooner the standard of the flock will be raised.

There are still too many farmers who argue that all rams are alike, and that a £3 ram is as good as a £10 or £15 ram. Until South African sheep farmers appreciate the value of a good ram the desired improvement in our flocks cannot be effected.

Buy rams from a recognised breeder of long standing, whose flock has been "clean" bred and consistently "line-bred," and if you do not afterwards breed your own rams, continue to purchase from the same breeder as long as you own a sheep. In this way your sheep will be influenced by the good that blood confers, namely, family likeness, uniformity, and prepotence. Do not frequently change your ram breeder, as uniformity cannot be obtained in this way.

On no account would I recommend the purchase of rams from a recently established so-called stud flock which has two or more distinct breeds in its composition, as rams of this heterogeneous description would infuse so many different strains of blood into the flock to be bred back to that it would become a regular "London mixture" which has lost all family likeness and uniformity.

The flocks of South Africa have been very materially improved by sheep classing during the last ten years. It is sincerely hoped that sheep farmers will generally realize the importance and necessity of improving the Union's sheep industry, and will adopt a more rigorous and thorough system of sheep classing in the future — *Journal of Industries*, South Africa.

MILK AND UNPLEASANT ODOURS.

Milk is a substance which is very sensitive to any objectionable odours pervading the atmosphere. More especially is this true of milk freshly drawn from the cow and still retaining its natural heat.

Some little time ago (says a writer in the *Agricultural Gazette*) a herd of milking cows were put to graze in a field in the corner of which a calf had been interred, but not sufficiently deep. As putrefaction proceeded, the miasma of decomposition polluted the atmosphere wherein the cows were breathing. The milk of these cows was found to be unfit for consumption, and not only this, but the contagion

seemed to pass to other cows with which they came in contact in the sheds during milking. This is a very curious and unusual incident, and one which would have, no doubt, offered interesting points for thorough investigation. In the case of the cows breathing in the polluted air, it would seem that the odour was carried in some way by the blood-stream and absorbed by the milk as *the blood circulated round about the udder. It would be possible for milk tainted in this way to give off the odour immediately after milking, and for the odour thus* transmitted to the atmosphere to be again absorbed by untainted milk from other cows in the shed. It is generally contended that milk is pure and free from odours other than those specially characteristic of the substance as it is drawn from the cow's udder, and that contamination generally takes place after milking. But milk is a curious thing to deal with, and our knowledge with regard to the chemical and bacteriological aspect of it is still imperfect.

It is a well-known fact that milk readily absorbs the odours of a cowshed. The very objectionable taints which follow the use of certain roots and vegetables as foods for the cows are attributed very largely to absorption from the atmosphere, which generally simply "reeks" when such foods are being given. Again, in the dairy it used to be an almost universal custom to keep other foodstuffs, such as cheese, pickles, &c., on the shelves beside the milk. The odours from these were readily absorbed. This practice, though less common now than in former days, is still carried out in many places. The taint is objectionable, but so long as it is not so strong as to be nauseating, the milk can be used without detriment to any one. Food taints do not, as a rule, render milk unwholesome. Beyond impairing the flavour, there is nothing which is harmful. Many taints, other than those due to the absorption of food odours, do render the milk unwholesome, and, indeed, in some cases, actually dangerous to consumers.

The above facts do demonstrate with unmistakable truth the very urgent necessity for care in the production of milk. Not only must the buildings in which the cows live and are milked be kept scrupulously clean, but the air which they breathe must be pure and fresh. Cleanliness in every respect is absolutely indispensable for the production of good, sound milk. Pure, really clean milk is so necessary for the health and well-being of the people who consume it. A strong, healthy grown-up person generally has enough vitality to resist the ordinary sources of illness which are carried in milk produced without due lack of care, and such a person, as a rule, only takes a relatively small quantity of milk as an accessory to his ordinary diet. He is in no way dependent upon milk for the food units necessary to maintain life day by day. But an infant, whose resisting powers are immeasurably inferior to those of an adult, is dependent upon milk for all its food. It is small wonder that its health becomes seriously impaired—even if the flame of life does not flicker fitfully and then die out altogether—when the poor little body, in the first weeks of life, when all energy should be concentrated on growth and development, has to carry on a totally unnatural struggle against disease germs and other unwholesome elements continually present in the only food which Nature allows it to consume.

—*Farmers' Union Advocate* (N.Z.), 21.6.19.

CO-OPERATION IN AUCKLAND.

The annual report of the Auckland Co-operative Egg Producers Association contains the following.

Your executive has pleasure in submitting the annual report, statement of accounts, and balance-sheet. To comply with the *Industrial and Provident Societies Act* 1908, under which we are registered, our accounts are now made up to the 31st December in each year. The result of the year's work has again proved very satisfactory.

After writing off the sum of £153 15s. 7d. to depreciation, the profit and loss account shows a credit of £301 4s. 1d. The cost of running our business works out at a little below 9 per cent. The growth and turnover of the society is steadily increasing, as shown per table below. The shipping companies and Railway Department again increased their charges during the year, and in consequence our railage and freight charges, by way of comparison, are 25 per cent. higher than the previous year's account.

	Dozens Eggs Sold	Eggs Realised.	Fowl Feed Sales.	Totals.
1st year (12 months)	107,101	£8,000	£1,225	£9,225
2nd year (18 months)	364,476	£28,111	£5,346	£33,457
3rd year (9 months)	267,008	£23,158	£3,893	£27 051

Our turnover during our last year, as compared with a similar period for the previous year shows an increase of 64 per cent.

COMPARISONS OF MONTHLY AVERAGE PRICES PAID OUT.

For twelve months ending 31st December, 1916—128,480 dozen .. 1s. 5½d.
For twelve months ending 31st December, 1917 249,506 dozen .. 1s. 6¼d.
For twelve months ending 31st December, 1918—311,951 dozen .. 1s. 8¼d.

It will be seen from the above figures how the society has steadily grown, and how members are securing the benefit of co-operation.

LIKE other soil bacteria, the nitrogen-gathering bacteria, or legumes, are greatly benefited by lime. Lime and legumes, like the clovers and trefoils, will help to make up for the shortage and high price of manures.

THE principal object of manuring farm crops is to increase the yield, but other results follow. The quality of the crop is improved, its date of ripening in some cases hastened, its power to resist disease is strengthened, and its feeding value made greater.

ORCHARD AND GARDEN NOTES.

(*E. E. Pescott, F.L.S., Pomologist.*)

The Orchard.

If the winter spraying has been delayed, it should be completed as quickly as possible, and before the buds begin to swell and burst.

It is not advisable to spray the stone fruits with the red oil emulsion at this time, as there is danger of burning and destroying the early buds that may be swelling, and consequently loosen their outside scales It will be safe, if the work be done at once, to spray apple, pear and quince trees with this spray, especially where the Eyrobia Mite, scale insects, or woolly aphis are prevalent.

If it is intended that the lime-sulphur wash be the specific for these and other pests, it may be used with safety, although the spraying should be completed as early as possible.

That the lime sulphur is valuable as a specific against "Black Spot" of the apple was shown in the report of the experiments in the *Journal of Agriculture* for August, 1918. The first spray should be given when the flower buds are more green than pink; and the second spray, when the centre flowers of the blossom cluster are pretty open.

The same report showed that a spray of 6.8.40 of copper-soda, sprayed when the earliest buds were showing pink, was a complete success against the "leaf curl" of the peach.

Where peach aphis has appeared, it will be advisable to spray at once with a strong nicotine solution. Tobacco stems should be soaked in cold water for some days, and a teaspoonful of caustic soda added to a cask of steeping stems. The liquid should be made strong, and every endeavour made to kill out the first insects that appear.

The pruning of deciduous trees should be at an end this month The pruning of evergreens such as oranges, lemons, and guavas, may be left until later.

Young deciduous trees must be planted not later than this month. The soil should be trodden firm round the roots, and, when planting has been completed, the tree ought to be headed back to three or four buds on each arm.

Preparation may be made for planting citrus and other evergreen trees. It is necessary that the soil be well ploughed and sweetened in anticipation of planting in September and October.

In root-borer affected districts, the beetles will begin to appear during the latter part of the month. A close observance should be kept on them and the insects regularly collected and destroyed.

The Flower Garden.

All winter-flowering shrubs that have dropped their blossoms may now be pruned. It is important to prune these immediately after flowering, so that the plant may be able to make plenty of flowering wood for next season.

Seed beds and plots need constant cleaning and weeding. Weeds must now be kept out of the garden, both by hoeing and hand picking. The seedlings growing in their permanent situations should be thinned out and given a good chance to develop strong and sturdy plants.

Divisions of herbaceous plants such as delphiniums, cannas, shasta daisy, herbaceous chrysanthemums, rudbeckias, salvias, and phlox, may still be planted out. If it is intended to leave the plants in the places they occupied last season, they should be lifted, the soil being well dug and manured, and the crowns planted back again. By this means the plants retain their vigour, and are able to produce good flowers each season.

Evergeen shrubs may now be planted out, if the spots chosen for them have been well dug and aired. All beds should be well dug over by this time, manure and refuse litter having been dug into the soil.

A few corms and tubers of early summer flowering bulbous plants may now be planted.

The Vegetable Garden.

The plots should be well dug over at this time, adding gypsum or lime where any pests have been prevalent. In other beds stable manure should be well worked into the soil.

The soil should be rich, well worked, and warm, so that a quick growth may result. Vegetables quickly raised are generally more tender than slowly grown ones; and frequent changes of crops in the plots will give better results. At this season, the weeds will require constant checking; frequent use of the hoe will, therefore, be necessary, and in the rows hand-weeding should be resorted to.

All seedlings should be planted out, especially seedlings of cabbage, cauliflower, lettuce, and onion. Seeds of peas, carrots, parsnips, radish, lettuce, tomato, and broad beans may be sown.

Where they can be sheltered and protected from frosts, young tomato plants may be planted out for early fruiting. One method of managing these early plants is to place the young plant a few inches below the surface, and then a box, 8 or 9 inches deep, with top and bottom removed, over the plant at ground level. This can then be covered loosely with a piece of glass whenever necessary.

Potatoes, artichokes, and asparagus crowns may be planted. Asparagus beds should be kept free from weeds; they should have a loose surface, and a light top dressing with old manure would be beneficial.

In the frames, cucumber, vegetable marrow, melon, pumpkin, water and rock melon seeds may be planted. These are best planted in pots placing three or four seeds in each pot; they then suffer no check when being transplanted into beds.

REMINDERS FOR SEPTEMBER.

LIVE STOCK.

HORSES.—Feed stabled horses well; give green stuff if available. Continue rugging to encourage the shedding of the coat; good grooming will also be beneficial. Give hay or straw to grass-fed working horses. Feed old and badly-conditioned horses liberally. In foal mares due to foal early, if worked, should be turned out to paddock. Stallions doing stud duty should be fed liberally. Equivalent amount of cracked Indian corn (maize) may with advantage be substituted for oats, if latter grain is scarce.

CATTLE.—Cows should still be rugged, but coverings should be removed frequently, in order to enable the animal to get rid of the old coat; or, better still, a good curry-combing may be given. Continue hay or straw. Look up treatment for milk fever in *Year-Book of Agriculture*, 1905, and treat cattle accordingly. Give calves a good warm dry shed. Give the milk to young calves at blood heat. Have feeding troughs or buckets clean. Don't over-feed. Feed regularly with regard to quantity and time. Provide a good grass run, or fine hay or crushed oats in a box or trough. Give a cupful of limewater per calf per day in the milk. The problem with many at the present time is how to rear calves without milk. This can be done very well by starting them on new milk for a fortnight, and then gradually substituting the milk with one of the calf meals on the market. To these it would be advisable to add two or three tablespoonfuls of cod liver oil. The following meal is in general use in Ireland :—Two parts, by weight, of oatmeal, 2 parts maize meal, 1 part pure ground linseed, all finely ground. Scald with boiling water, and allow to stand for twelve hours. Start with new milk, then gradually substitute skim and ¼ lb. daily of the meal mixture per head per day, gradually increasing to 1 lb. or more. In a month milk may be dispensed with altogether. The crushed oats, fed dry, have been found to give excellent results.

PIGS.—Supply plenty of bedding in warm well-ventilated sties. Keep sties clean and dry, and feeding troughs clean and wholesome. Sows may now be turned into grass run. If pigs are lousy dress with kerosene emulsion or sulphur and lard, rubbing well into crevices of skin, and disinfect sties. Worms are very prevalent at present, and may be treated by giving 2 to 10 grains of Santonin in form of pill, or from half to one teaspoonful of oil of turpentine in milk or castor oil.

SHEEP.—Wherever early shearing is possible, and shelter available, all sheep to be disposed of can be fattened earlier, if shorn. Sheep or lambs not good enough for freezing also thrive better after being shorn. Where insufficient knowledge of grading cross-bred wool exists, draft the coarse sheep from the fine before coming into the shed, and shear and bale separately. Clean all daggy sheep before bringing them on to the shearing board. Avoid deep and careless skirting. Only dense seedy parts, and heavy ribs and stains should come off fleeces. Press in a box press, which forms square sides to bales, and avoid round bales, called "Sew Downs." Pack in all possible. Brand boldly and neatly on the long and narrow side. Clean carefully all straw, chaff, &c., from shearing place. Cut back all misshapen feet when noticed during shearing. Mark all "duggy udder" ewes for disposal, and all black-marked and inferior-fleeced sheep.

Yard and go through all well bred Merino-Lincoln cross lambs before offering to exporters. Select, ear mark, and shear all best sorts for future breeding and shearing. Buyers will find shafty, well bred, fine to medium grade wools disappointingly scarce for years.

POULTRY.—September is one of the best months for hatching for winter eggs Incubators should be kept going, and broody hens set. Care must be taken to keep down vermin, as they now breed quickly; use sprays in houses and Insectibane or Izal in nests—nothing stunts chickens quicker than vermin. The food for young chicks should be fine oatmeal, stale bread crumbs or biscuit meal, a little calcined bird's grit, a little chopped green stuff such as lettuce, thistles, or green lucerne or spring onions occasionally cut fine is a good tonic, and

a pinch of powdered charcoal. Slightly moisten with new milk. Make the whole friable, and feed frequently ("little and often") just as much as they will readily eat, as an excess of food only sours and disturbs their digestive organs. Animal food may be given in small quantities after the first ten days once or twice a week. Chickens should be protected from damp ground and the cold, bleak winds.

CULTIVATION.

FARM.—Plant early potatoes, and work up fallow for the main crop. Keep fallow for summer forage crops well worked up with the disc and harrows. Make early sowings of mangolds, beet, field carrots, and turnips. Push on with the fallowing in the Northern Districts. Prepare land for tobacco seed beds by burning rubbish on the site; afterwards work up to depth of three or four inches.

ORCHARD.—Commence spring ploughing: plough in leguminous crops for green manure as soon as the plants are in full flower. Finish grafting early in the month. Spray peach and apricot trees with copper soda as the blossom buds are opening, as a preventive of "leaf curl" and "shot hole" fungi; watch for peach aphis, and spray when present with tobacco solution.

FLOWER GARDEN.—Cultivate and work up the surface to a fine tilth—clear out all weeds. Water newly-planted shrubs, &c., if the weather is dry. Plant out cannas, early dahlias, chrysanthemums, gladioli, and other herbaceous plants.

VEGETABLE GARDEN.—Plant out seedlings. Sow seeds for summer use, such as tomatoes, cucumbers, marrows, pumpkins, melons, &c. Plant out tomatoes, and shelter till frosts are over. Hoe and work up the soil surface.

VINEYARD.—Plantation of young vines (grafted or ungrafted) should be concluded before the commencement of September; pruning of old vines likewise, as well as tying down of rods on long-pruned vines. Prune recently-planted vines just before buds commence to swell (if not pruned when planted), cutting strongest cane back to two buds. Do not delay this work until buds have shot, as this seriously weakens the young vine. Field grafting may be carried out, if weather be fine and warm. If cold and wet, postpone until October. Swab vines preventively with acid iron sulphate to protect them from Black spot. Though only slight damage was done last season, the fungus is not dead, but dormant, and is sure to re-appear should the spring be a wet one. To avoid burning, swabbing must be completed before the buds commence to swell. (See articles in issues of July, 1917 and 1918, reprints of which will be posted on application.) Cultivation (scarifying or discing) must receive attention when soil is in suitable condition.

Cellar.—Conclude spring racking early in month, if not already done. Fill up, regularly, all unfortified wines.

MILK FOR CONSUMPTION IN TOWNS IN ENGLAND.

From the recently issued report of the English Board of Agriculture, it appears that 71 per cent. of the milk yield in England is sold as whole milk in towns, 12 per cent. is used for butter-making, 4 per cent. for cheese-making, and 1 per cent. is sold as cream. The remaining 12 per cent. is kept in the country for home supply. London alone consumes 92 million gallons of whole milk per year. The total consumption of milk in England and Wales is estimated at 731 million gallons, most of which is transported by rail. The average distance of the London supply is about 80 miles, but churns of fresh milk are sent from places about 130 miles distant; the most distant place mentioned is from Toom in Ireland, 513 miles from Euston station.

The New South Wales Dairy Expert (Mr. L. T. McInnes), in a report to the Department of Agriculture, refers to the revival of herd-testing on the New South Wales north coast. The Tweed-Richmond Herd-Testing Council has concluded its seven years testing under Government subsidy and direction. The records of the council for the year ending 28th February, 1919, give the individual productions of the cows in twenty-two herds, totalling 1,137. These show the average production to range from about 192 lbs. of commercial butter (calculated by the chart) to 298 lbs. Considering the extreme dryness of the season, these are very good results, and compare favorably with those of previous years.

The total number of cows entered for testing during the year was 1,283. The average yield of the whole of the cows tested was 233.6 lbs of commercial butter, as compared with 256 lbs. given in the two preceding years.

The Tweed-Richmond Herd-Testing Council has commenced its eighth year of testing, and is employing three testers, who are operating in connexion with three different units; a fourth unit is in process of formation.

FLAX GROWING.

There is a strong movement in British countries to stimulate the wider cultivation of the flax crop, its products, both fibre and oil, being urgently in demand. Prior to the outbreak of war, the flax industry flourished in Russia, France, Belgium, Germany, Austria, Holland, and Ireland, the first-named producing four-fifths of a total of 500,000 tons. All these countries must be in a bad way in respect of their normal production, and there must eventually be a great shortage of linseed, fibre, &c. The price for flax products should rule high for some years. In reviewing the position, the *Cordage Trade Journal* says:—"So far as flax prospects are concerned, they are anything but encouraging. We may fear that the coming year will witness prices much beyond anything we have yet seen, for the simple reason that there will not be sufficient flax to go round." A recent issue of the *Irish and Scotch Linen and Jute Trades Journal* contains the following:—"For some years the present high price of flax will be maintained. It may be accepted as pretty certain that remunerative prices will rule for ten years. Stocks of linen throughout the world will have to be replenished, a task that will take years. In addition, there will be a big demand for aeroplane sheeting for commercial and other purposes."